Dear Readers,

Happy summer to our readers—or maybe fall by the time this reaches your door. Here is our twentieth issue of *Wrack Lines*, now in its twelfth year of publication. This issue contains a potpourri of fascinating subjects for you to explore.

The Editorial Board decided to go ahead with a new strategy, a transition to less lengthy articles, so we can present a wider range of topics. We’d love to hear your thoughts about the new format. For the next issue, we hope to have a wonderful new design as well. Please send your comments and story ideas or submissions to seagrant@uconn.edu.

I’m personally very excited about a new regional effort through the Northeast Sea Grant Consortium to try to help both right whales and the lobster industry. You’ll find this and more inside.

I’m also delighted to inform you that the previous issue of *Wrack Lines*, which featured Tropical Storm Irene damage on the cover, won an Apex 2012 Award for Excellence in Publications. Hats off to the excellent authors, photographers, and proofreaders who helped to make that happen.

Finally, I’d like to close by thanking everyone who sent in articles, photos, and suggestions for this issue. That list includes the *Wrack Lines* Editorial Board, a dedicated group of University of Connecticut faculty who volunteer their time for this task.

Your editor,

*Peg Van Patten*
Wrack Lines
Volume 12 Number 1
Spring/Summer 2012

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Wrack Lines is published twice a year or as resources allow by the Connecticut Sea Grant College Program at the University of Connecticut. Any opinions expressed therein are solely those of the authors.

There is no charge for Connecticut residents, but donations to help with postage and printing costs are always appreciated.

Change of address, subscription information, cancellation requests, or editorial correspondence should be sent to the address below:

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About our cover:
The light bulb tunicate is a new-comer to Long Island Sound.
Photo by Jamie Reinhardt.
In February 2011, NOAA scientists managed to sedate and disentangle this young North Atlantic right whale found off Florida caught in fishing line and wire mesh. It was only the second time that sedation had been used for detanglement rescue. With only 300-400 remaining in existence, North Atlantic right whales are among the most endangered whales in the world. They are protected under the U.S. Endangered Species Act of 1973 and the Marine Mammal Protection Act of 1972. Vessel strikes and entanglement in fixed fishing gear are the two greatest threats to their recovery.
At certain times when whales in the waters off New England congregate in areas densely packed with ships and fishing gear, whales suffer the consequences. Especially at risk is the northern right whale, *Eubalaena glacialis*, which is critically endangered and close to extinction. These right whales are slow-moving baleen (plankton-feeding) whales. Historically, beginning in the 11th century and up to 1935, they were heavily hunted for oil and baleen; baleen was used to fortify ladies’ corsets and other products. There are now believed to be less than 500 individual northern right whales left.

The New England Aquarium keeps a catalog of individual right whales with identifying characteristics and family relationships. They have been very involved in right whale research and conservation, and even have an Adopt a Right Whale program. (Editor’s note: see http://www.neaq.org.)

Much of the whale injuries and mortalities in recent times have been related to ship strikes, which have been addressed by slightly moving shipping lanes away from whale migration routes, and limiting vessel speed. It’s now illegal to approach a right whale within 500 feet. There is also a phone app to help ships avoid them. Of course, habitat loss and ocean pollution add to the whales’ plight.

Other human practices can be addressed. About half of the human-caused right whale mortality now is from entanglement with fishing gear, scientists believe. It’s hard to tell exactly, because a dead whale may not be easily visible. The gear is generally gillnets and lobster pot lines.

The pursuit of America’s favorite crustacean is a practice that appreciative New England diners tend to enthusiastically support. So far, Maine lobstermen generally fish trawls with up to five traps on a single surface buoy. When the trawls are longer than five traps, they put a surface buoy on each end to guard against gear loss in case something breaks. To prevent whale entanglement, regulations specify use of sinking ropes rather than floating ones. This rule doesn’t apply in the first three miles off shore since whales do not tend to congregate close to land. Most fishermen dislike the rule because the sunken lines can wear out when they chafe against rocks or get snagged on rocks and debris, resulting in damage and gear loss. Meanwhile, regulatory agencies have found that the current management rules are not helping enough to preserve right whales so they are gearing up to regulate fisheries more stringently.

Hauke Kite-Powell, research specialist at the Woods Hole Oceanographic Institution’s Marine Policy Center, became involved in the dilemma when he was contacted by the Maine Lobstermen’s Association. Knowing of his earlier work with shipping lanes and whales, they wanted to work with him as well as the New England Aquarium to address the problem. The idea is to gather information on both right whale movements and lobster fishing, to build a reasonably accurate model for where and when risk to the whales from lobster gear is highest. Once that is known, place-and time-specific recommendations can be made that might be most effective and possibly also less burdensome to fishermen. In order to do that, it was essential to know where the whales are likely to be at a particular time and season and, simultaneously, where the lobstermen are fishing.
and what gear they are deploying.

They put together a proposal and now a Sea Grant project sponsored by the Northeast Sea Grant Consortium, which comprises the Sea Grant programs from Maine to New York, is helping them to look at solutions for this problem, focusing on conflicts between the right whale and Maine lobstermen. New England Aquarium and the Maine Lobstermen’s Association are key partners in the effort.

To help, lobstermen came forward with information about their fishing habits, drawing the places they frequented on charts. Without their willingness to provide information that they normally would rather not share, the project would not have been possible, said Kite-Powell.

“We have a pretty good handle on where the right whales are and when, beyond ten miles off the coast,” said Kite-Powell, who leads the project. Spring and summer are the peak times that they gather in large numbers. New England Aquarium staff have been combining systematic offshore whale survey data with satellite tag surveys and sporadic inshore sighting reports. The combined information gives a more complete picture of how often and when the whales are present both inshore and offshore.

What’s unique about this Sea Grant project is the collaboration. “The biggest challenge for this project is reaching out to thousands of people involved in a fishery who really don’t want to tell what they’re doing,” said Kite-Powell. They are cooperating, he said, in hopes that there will be a sound scientific basis for future regulations that they can support because they will have had input to the process.

“It’s unlikely that a solution would happen at all without the help of the Maine Lobstermen’s Association,” Kite-Powell adds. “I believe that if we approach the problem carefully and design management measures to target the risk where it exists, it will be possible to protect whales AND allow lobstermen to pursue their livelihood without being overburdened,” he said.

Kite-Powell hopes that the NOAA National Marine Fisheries Service, under constant strong pressure from environmental groups, won’t forge ahead and institute management regulations using an existing broader-based model for the Northeast before his model can be completed. While the earlier model covers a larger geographic area, it lacks the specific detail that the new project can provide. The next challenge will be talks between the project partners, environmental groups, and regulators, he says. The talks will attempt to get appropriate whale risk reduction measures adopted using recommendations generated from the new targeted model.

“Ultimately we want to keep whales from getting tangled in fishing gear,” he said, “so we just do everything we can to put the best science forward and then explain it to everybody. Protective measures for the right whales will be put in place sooner or later, but for the sake of the whales I hope it’s sooner.”

About the author:

Peg Van Patten is Communications Director for Connecticut Sea Grant at the University of Connecticut. She enjoyed lunch with Hauke at Captain Kidd’s while working on this story.
"Each day as the sun rises and retires the beautiful green bays like great creatures breathe in and out."

H.T. Odum and C.M. Hoskin, 1958.

In 1958, Odum and Hoskin likened the daily rise and fall of oxygen in Texas bays to the breath drawn in and out of some great creature. This analogy can be extended even further to encompass not only our understanding of the daily oxygen cycle, but to relate how these bays may respond to our ever-increasing human population and the effects we have on coastal waters. When a creature is stressed and struggling, it may draw in a giant draught of breath and then expel this breath in a whoosh. Bays dealing with the effects of human influences can also be seen to take in a giant breath, evident through extremely high oxygen concentrations during the day. This in-drawing of breath is followed by a huge reduction in oxygen at night. This “panting” of the bays results from the production of oxygen during the day by the large amounts of primary producers, which are plants and plant-like creatures that use the sun as an energy source versus getting their energy from eating. These primary producers also require nutrients, much of which are supplied by human activities in the watershed. The primary producers and all of the creatures that feed on them respire at night, reducing the oxygen available in the water.

In an estuarine system, the water column is usually stratified, meaning that there is a distinct bottom and surface layering to the water column that inhibits mixing between the two layers. This stratification results from density differences, with the saltier denser water on the bottom. Without access to the air, the bottom layer has no way to replenish the respired oxygen, until the sun rises and the primary producers begin to generate oxygen. In systems deep enough to have no light in the bottom layer, such as the main stem of Long Island Sound, the oxygen remains low until the weather cools or a storm event is strong enough to mix the water column. Larger swings in oxygen indicate systems experiencing stress, especially when the down swing brings the oxygen so low that animals in the area find it hard to breathe.

Monitoring throughout Long Island Sound (LIS) indicates that the Western Sound experiences low oxygen, or hypoxia, in bottom waters in late summer. The extent and severity of this hypoxia vary by year. The area exhibiting hypoxia in Long Island Sound is monitored via a buoy network and biweekly cruises conducted by the Connecticut Department of Energy and Environmental Protection. While this monitoring effort provides an assessment of hypoxia in the main stem of LIS, very little is known of the hypoxic condition in the more than 70 bays scattered along the shoreline. These bays are the areas most accessible to people and are also areas that are greatly impacted by humans.

These coastal bays provide a vital service to both marine animals and humans. The bays serve as a nursery ground and source of food to many commercially, recreationally, and ecologically important species (for example, lobster, blue crab, winter flounder, etc.). The plants growing in the estuaries and the animal communities supported by those plants feed migratory and resident populations of birds. Humans enjoy many activities in these bays, including fishing, shell-fishing, boating, paddling, and swimming. These areas host our marinas, yield our dinner, and provide a wide assortment of recreational outlets.

Small coastal bays are the receiving waters for much of the nitrogen (N) and phosphorus (P) being delivered into LIS. These enclosed areas are strongly affected by the N and P entering the coastal zone and also serve to remove some of...
the nutrients before they reach the main stem of LIS. This removal is accomplished by the use of N and P by primary producers both large and small. Most visitors to the seashore have seen the plant matter clinging to the rocks or washed up on the beach. This plant matter consists of seaweed in shades of green, red, and brown.

While seaweed is not a true plant (with roots and leaves similar to land plants), the beach visitor to the Eastern areas of LIS is likely to encounter one of our true plants capable of living in salt water: eelgrass (*Zostera marina*). These long eel-shaped blades or leaves form the above-ground portion of the plant.

In addition to the macroscopic primary producers, microscopic algae (phytoplankton) are also present in the water. All of these primary producers respond to nutrients in the water column by growing and reproducing, just as a backyard garden responds to fertilizer. When the N and P increase, the primary producers which respond fastest in shallow waters tend to be the seaweed. These crops of fast-growing seaweed may shade slower growing seaweed and eelgrass, potentially changing the habitat characteristics to such an extent that the community of animals inhabiting the area may shift to include other types of animals. In some cases, the animals most desired by humans (for example, scallops, fish) may vacate the area. Excess nutrients entering bays accompanied by the onset of hypoxia may result in the loss of recreationally and commercially valuable species and a decrease in our ability to enjoy the area (for example, beach closures, noxious smells, fish kills).

While scientists understand the theoretical links between nutrient input, growth of the primary producers, and hypoxia, our practical knowledge of these small bays is limited. We have yet to “take the pulse” of many of these bays and translate a theoretical knowledge of processes into the practical identification of the severity and extent of hypoxia.

In 2011 and 2012 with funding from the Long Island Sound Study, Connecticut Sea Grant and New York Sea Grant, my colleague Charles Yarish (University of Connecticut) and I set out to sample eight bays on Long Island and along the Connecticut shore with the goal of determining if hypoxia in these bays is occurring and how widespread the problem might be. Along the Connecticut shore, sites stretched from the Stamford area in the West (Holly Pond) to Stonington Harbor in the East. Along the shore of Long Island, we sampled from Cold Spring Harbor in the West out to Mattituck Creek in the East. These sites spanned a range of sizes and a range in the amount of nutrients entering the system from the land. In some, such as Holly Pond, the watershed was highly urbanized. In others, such as Stonington Harbor and Mattituck Creek, the watershed included a mix of natural vegetation (forests, wetlands), low to moderate human development, and agricultural lands. The goal was to identify what types of estuaries may be experiencing hypoxia, based on what we know of the activities occurring in the watershed.

The oxygen content of the water should be lowest just at dawn, as all of the organisms have been respiring and thus depleting the oxygen throughout the night. Once the sun rises, the primary producers begin to pump oxygen back into the water as they go about their business of photosynthesizing. We were interested in capturing any short-lived hypoxia, as well as hypoxia that might linger later into the day. So, our alarm clocks were set for 3:30 am and we headed out into the field to greet the dawn in our hunt for hypoxia.

What we found mirrors the trends seen in the main stem of Long Island Sound. The lowest oxygen levels and greatest area of lower oxygen waters were seen in the Western Sound bays, where the urbanization in the watersheds is greatest. The Long Island Sound Study defines hypoxia as waters with an oxygen concentration of 3 mg/L or lower. Using this defining point, only Cold Spring Harbor evidenced widespread hypoxia. An interesting finding was that hypoxia in Cold Spring Harbor was more severe (0.5 to 2.4 mg/L) than what was seen in the main...
stem of Long Island Sound (~4.2 mg/L) during this same time period. This indicates that the hypoxia is not derived from the main stem of Long Island Sound, but a process driven from within the bay. Only three other sites exhibited hypoxia, and the incidence of hypoxia was limited to the “head” of the estuary, or that portion furthest from Long Island Sound. These inland portions of the bays are the receiving areas for freshwater inputs. These freshwater inputs carry nutrients from the land into the bays and eventually out to Long Island Sound. That source of nutrients and the level of primary production it supports is the likeliest cause of hypoxia in these bays.

Work in these same systems will continue in the summer of 2012. By adding an additional year of sampling in the same sites, we’ll begin to evaluate the inter-annual variability of hypoxia. The ultimate goal is to identify bays with a high risk of experiencing hypoxia. These sites are in need of greater efforts at nutrient reduction, which should, in turn, reduce the severity of hypoxia and improve conditions for the many valuable species of organisms that use these bays for nursery grounds and as a source of food. This will provide healthy coastal waters for human activities such as fishing, shell fishing, boating, and swimming. We need to reduce the stresses on these “great creatures,” moving the panting occurring in the most belabored bays into the more natural rhythm characteristic of the breathing of the bays.

Area and severity of hypoxia (lack of oxygen) in bottom waters of Niantic River on August 5, 2011. The color scheme follows that used by the CT DEEP for Long Island Sound hypoxia maps:

- = severe (0.0 – 0.99 mg/L),
- = moderately severe (1.0 – 1.99 mg/L),
- = moderate (2.0 – 2.99 mg/L),
- = marginal (3.0 – 3.49 mg/L),
- = interim management goal (3.5 – 4.79 mg/L),
- = excellent, supportive of marine life (4.8+ mg/L).

About the Author

Jamie Vaudrey is a marine ecosystems ecologist and an assistant research professor in the Department of Marine Sciences, University of Connecticut.
The lightbulb tunicate, *Clavelina lepadiformis*, photographed by the author. It's easy to see how it got its name!
Discovering the Light Bulb Tunicate

by Jamie Reinhardt

There is always a sense of excitement when you see something for the first time. I had spent a considerable portion of the summer of 2009 surveying various underwater habitats along the southern New England coastline from Branford, Connecticut up to Newport, Rhode Island. While I always enjoy donning my SCUBA gear and spending some submerged time photographing animals that live on the bottom, the summer had mostly been filled with photos of the usual suspects (the sea squirts Botryllus schlosseri and Botrylloides violaceus). It was just another dive late in the year. I had brought along my dive buddy Dave Hudson, a crustacean physiologist and invasive crab expert. The plan was to simply go down and survey a breakwater in Stonington Harbor, taking some biomass samples and photographs haphazardly along the wall. It wasn’t more than 20 minutes into our dive that Dave tugged at my fin and signaled me to take a closer look at a segment of the wall I had just passed. Dave knew that this species was unique; I knew that we needed to get a sample.

The light bulb tunicate (Clavelina lepadiformis) is both distinctive and conspicuous, meaning that it is easy to see and identify. Clavelina is a colonial ascidian (sea squirt), small individuals (zooids) are attached together to form a larger colony. It appears to have fluorescent white lines running down the front and sides of an individual while the rest of the body appears translucent. It is easy to see why its common name is the light bulb tunicate. Usually Clavelina lepadiformis is found in Europe, and has a natural range from Norway in the north all the way to the Mediterranean Sea. As a species it survives well in fresh Norwegian fjords (with lots of cold freshwater runoff) as well as the highly saline Mediterranean, and of course can deal with those temperature extremes as well.

We collected the sample. Dave and I scraped the 5 or 6 zooids into a plastic Ziploc® bag with my dive knife, and sealed the bag shut. I felt lucky that we were able to retain all of the colonies that we had seen, to make sure we had a large enough sample for a proper taxonomic and genetic analysis. Dave and I swam on, continuing our survey. But when we swam around the next turn along the wall, we were amazed. The water was bright from all of the “light bulbs” in the water. Wow, I thought, I guess we did not collect the only specimens. A couple of things came to mind: 1) this species is new here and 2) has the ability to quickly become a dominant part of the community.

Back in its native range Clavelina can also be a relatively dominant species on shallow rocky surfaces. But could it be anything like this? Dave and I would have to come back to get a better quantification of the community characteristics, but for now we wanted to get back to the University of Connecticut at Avery Point as quick as we could in order to get an identification of the New Invader.

Although Clavelina lepadiformis is distinctive enough to identify without complicated techniques, we needed to be sure. So, we enlisted University of Connecticut molecular and ascidian taxonomic expert Lauren Stefaniak. When Lauren got back to us, not only did she provide us with a species identification, she was able to identify the samples of Clavelina as belonging to an invasive strain of the species in European harbors and ports! Researchers in Europe had already been doing some work on the genetics of Clavelina and comparing different genetic strains. It appears as if the populations of Clavelina that exist within harbors and ports in Europe are different from those that naturally occupy the rock outcrops outside the harbors. Even harbor populations as far away as Spain and Germany might be genetically more similar to each other than two populations that are separated by two or three miles. This is because the ships that transport cargo between two ports also transport other unintended things. As the genetic data suggest, Clavelina is one of those unintended “hitchhikers”. Organisms like Clavelina and other tunicates like to settle on the bottoms of ships because they provide plenty of hard surface to grow on. For this reason, Clavelina, other ascidians, barnacles and other marine animals that settle on hard surfaces are called fouling organisms.

Later in the week Dave and I loaded up the University of Connecticut’s 24 foot Boston Whaler with our dive equipment to head back to Stonington Harbor. We needed the boat to access some more restricted areas of the harbor to survey the extent of the Clavelina infestation. We found out that while the populations were localized (limited to 2 or 3 structures), Clavelina occupied over 30% of the substrate in some areas. In other words, Clavelina was a large portion of the total biological matter in some areas.
What does the invasion of Clavelina mean for our local biological communities and ecology? Animals like Clavelina can have many nasty consequences for the ecosystems that they invade, as well as for local industries which rely on the ocean. For instance, when Clavelina or other fouling organisms start growing in the intake pipes of power plants, this reduces the flow rate of water and decreases the efficiency of cooling. Running power plants at less efficient levels is costly to all of us and may be reflected in the price of a kilowatt that you need to run your own light bulb.

Along the Connecticut coast there are many shellfish aquaculturists who are acutely aware of the negative consequences of fouling organisms. Oftentimes fouling organisms can grow on the shells of oysters or on the nets that oysters are grown in. When this happens, the fouling organisms can interfere with the efficient feeding of the shellfish by both blocking and reducing water flow or by directly competing for food resources. Shellfish farmers spend a great deal of time and money preventing the fouling of their produce and constantly cleaning their nets.

Since power plant operators and shellfish farmers already have to deal with fouling organisms, what difference does it make that one more ascidian comes along and is added to the “problem list”? Steve Malinowski, owner and chief scientist at Fisher Island Oysters, explained it to me best: It is not just that there might be more biomass to remove at any one time from your nets, it’s that you might have to do it later into the season or into the winter. Continuing intense cleaning operations into the winter not only is costly but for operations in New England and Maritime Canada can be dangerous. Winter is the time when the waves pick up and doing complicated procedures in cold water means increased risk for laborers.

So what can we do? Eradication of an invasive species is a difficult proposition. Although eradication has been successful in a few circumstances, this option is usually cost-prohibitive. Instead, everyone can do their part to decrease the risk of spreading invasive species and other unwanted pests (not just in the ocean but for terrestrial and freshwater too!). For people who like to boat and fish—and that’s a lot of us—make sure to clean your boat hull regularly and always do so when you transport your vessel to another lake or body of water. Make sure you dispose of bait packaging (often seaweed from a distant location) in the trash and not over the gunnel. Check out useful resources at Connecticut Sea Grant online at http://seagrant.uconn.edu/whatwedo/ais/. We all can keep a watchful eye on our coastline.

When you are down on the Connecticut shore this summer, spend some time getting to know the plants and animals along the beach and dock. Whether you’re wearing a swimsuit and flip flops, a snorkel mask or a wet suit—maybe you’ll be the one who discovers something new!

About the author –

James Reinhardt is a recent graduate from the University of Connecticut Department of Marine Sciences. His doctoral work focused on the community ecology and patterns of recruitment of benthic organisms in Long Island Sound, particularly invasive species. Following his graduation Jamie served as a Dean John A. Knauss Marine Policy Sea Grant Fellow for the National Oceanographic and Atmospheric Administration’s Office of Habitat Conservation and is now continuing his work with NOAA as a contractor for I.M. Systems Group.
Seaweed Beyond Sushi: Culinary Institute of America Leads the Way

CIA chef Paul Crispo talks about and demonstrates his cooking techniques for a menu of delicacies featuring seaweed.

Yummy! Above, the CIA’s popcorn with a zing featuring butter and nori flakes. The nori flakes can be found at healthy food retail stores like Trader Joe’s. Below, Chef Crispo’s stuffed pork roll wrapped with seaweed.

The launch of a new cookbook, Fabulous and Flavorful Gim: a Collection of Korean Seaweed Recipes Developed by Faculty Chefs from The Culinary Institute of America, published by Korea Agro-Fisheries and Food Trade Corporation, was a very tasty occasion. Sea Grant extension agent Anoushka Concepcion, seaweed researcher Charles Yarish and school officials from the Bridgeport Regional Aquaculture Science and Technology Center attended the book launch at the CIA’s Hyde Park, New York campus with me and other invited guests and were treated to selected dishes prepared by Chef Phil Crispo. We were also asked to rate the taste and texture of various items according to preference.

The attendees heard Yongja Kim, a leading gastronomy journalist, talk about the historical and traditional Korean culinary uses and roles of gim (the Korean term for seaweed). For example, Miyoguk soup, a nutritious soup served on special occasions, is traditionally prepared for women giving birth and is then offered every year to the offspring as “birthday soup.” Toran guk soup, made with taro root, white radish and kelp, is served at harvest time and at ceremonies to honor ancestors.

While seaweed has long been a staple in the Korean diet, the CIA chefs and book author hope to “break the sushi mold,” appealing to the American and global palates in new healthy and appealing ways. The seaweeds they use are high in proteins essential for amino acids, high in vitamin C and fiber, yet low in calories. Some flavored Korean seaweeds are now offered for sale in this country at outlets such as Whole Foods and Trader Joe’s.

Bun Lai, a well-known chef and restaurateur who is also known for his environmental and social activism, told the chefs how he uses seaweed and how growing seaweed helps the environment. You can find Lai at Miyas Sushi in New Haven, Connecticut. New Haven, known for its exceptional restaurants, was also the original home of the Culinary Institute of America when it was founded in 1946, before it expanded and moved.

“Your job,” Lai told the student chefs, “is the most important because leaders who influence what people eat influence society as a whole.”

“It’s an incredibly dynamic time for food in our society,” he added. Lai talked about the problems Americans have that relate to unhealthy diets, such as cardiovascular disease and diabetes.

“What I did was rethink the idea of sushi,” said Lai. “Instead of serving white rice, I replaced it with multigrain rice. All the food I use in the restaurant is sustainably grown or fished.” He believes that people should open their minds

continued on next page
to eating foods that are both good for their bodies and the environment. Lai even developed a recipe for cooking Asian shore crabs. Asian shore crabs are very abundant small striped crabs which are documented as invasive nuisance species known to displace native crabs.

“Seaweed is ultimately sustainable food,” Lai said. “There is no fertilizer, no antibiotics, and no pesticides used to grow it.” Be conscientious about your choices, he advised.

Some seaweeds have a nutty flavor, some taste like chicken, and others vary in color, texture, or fragrance, chefs and tasters agreed. “Just like the chefs here, I started tasting different versions then categorized them by flavor and texture.” Lai said. “Now, with this cookbook, people can enjoy Gim every day.”

Korea produced 10 billion sheets of nori, the seaweed used in sushi and other foods, last year.

“You hold the key to the future,” Lai told the student chefs.

Yummy!

Seaweed-flavored gourmet ice cream was the pièce-de-résistance of the tasting opportunity at the CIA’s book launch event. While most ice cream contains carrageenan, a colloidal extract from red seaweed that makes it smooth and thick, this ice cream dessert was quite different because the seaweed itself was used for nutritious flavor and as a garnish. It tasted a bit like green tea to this taster. Recipes are featured in the new gim cookbook.
Meanwhile, Down on the Kelp Farm

In the previous issue of Wrack Lines, we ran a story on Sea Grant research that resulted in the establishment of a seaweed farm in Long Island Sound. We described the planting of the winter crop, kelp, in December. Now we'd like to show you the harvest in May! Charles Yarish, a professor at the University of Connecticut's Stamford campus, holds here a portion of the kelp crop hauled up, which he estimated at more than 600 pounds. To grow the kelp, juvenile “seed” is deployed underwater on long lines at depths of 1 and 2 meters. This first crop of kelp will be chemically analyzed to determine its content and quality for use as food.
Students at the Marine Science Magnet High School in Groton, Connecticut and their principal, Nicholas J. Spera, have enjoyed quite an amazing first year. The school opened its doors in September, 2011. The first students began learning fish biology in science classes and, using aquaculture techniques, began raising fish in tanks in the school’s labs.

The results were gratifying. With 600 grown fish, students wanted to learn entrepreneurial business practices as well as science. They found a willing partner in Sean Coleman, general manager of Grossman’s Seafood, who expressed interest in buying the fresh tilapia and rainbow trout grown by students. But there was no legal means to license such sales. So a new law that the students call “the fish bill” was proposed.

The bill to facilitate licensing for the seafood sales, supported by State Senator Andrew Maynard from Stonington, was proposed to the General Assembly. The bill clears the way for the students to sell their fish to market for food consumption. Grossman’s Seafood plans to buy a portion of about 600 tilapia and rainbow trout to sell in its market and distribute to restaurants.

“Our students set about changing the law in our very first year!” Principal Spera says proudly. Spera and two teachers accompanied four students to the Capitol, where, after waiting all day, they were able to testify before the State’s Environment Committee. The bill passed the Senate unanimously in May 2012.

The students also clean up the aquaculture wastewater by recirculating it, using nitrogen and phosphorus as nutrient to grow herbs such as basil using hydroponic techniques.

“Our students aren’t learning only science and math in the labs, they are also learning about policy and government, stewardship, and the importance of teamwork to achieve common goals.” Spera said.

Another popular hands-on learning activity at the school is the state-of-the-art navigation simulator. Students learn to navigate a ship using a full scale pilot model station. The model has the capability to change conditions during navigation, for example, by adding rain or snow. As they steer, students are calculating angles, learning geometry and applying their math skills.

The school, which presently has 70 freshmen, received 486 applications for admission. It was featured as a WFSB Channel 3 “Cool School.” Innovation is the philosophy at this school. When it was time to stock the new school’s library, Spera looked at the available space and the scope of the knowledge the students would be expected to master, and then made a decision about stocking the shelves. The library now holds a cabinet with 20 iPads for students to use, providing instant access to a wealth of knowledge.

The school is the third in a series of marine science-focused high schools authorized for development by the Connecticut State Board of Education. The others are the Bridgeport Regional Aquaculture Science and Technology Education Center and the Sound School Regional Vocational Aquaculture Center in New Haven. All strive to combine rigorous academics with practical hands-on experiences for their students.

After this auspicious beginning, it’ll be interesting to see what the Marine Science Magnet High School accomplishes in its second year! To learn more about the school, visit http://www.marinesciencemagnet.org/.
“There may have been stars, but the blackness of the night was so intense one could not see anything like a horizon” recalled the late Marshall Drew, who survived the tragic sinking of RMS Titanic as a young boy a century ago. “As row by row of the porthole lights of the Titanic sank into the sea this was about all one could see,” he said. In his memoir, he recalled being precariously lowered in a lifeboat during the night with his aunt, some 70 feet to the dark sea below. He was surprised to see that the steerage section of the White Star line’s ill-fated, brightly lit luxury liner was completely blacked out. Later he could hear screams in the distance, but he couldn’t utter a sound.

Drew, a New York City art teacher born in Greenport, Long Island, later taught oil painting when he lived in Westerly, Rhode Island. He was only eight then and was on a trip intending to visit his father’s family. He never forgot the darkness and ironic calmness of the Atlantic Ocean on the night of April 14-15, 1912 when the legendary White Star “Ship of Dreams” hit an iceberg, tearing a long gash in its side that sealed its watery fate.

When I met Drew as an art student, I noticed that he liked to paint landscapes. I completely understand why. Adopted by an aunt and uncle after losing his mother, the little boy then lost his uncle Jim when the “unsinkable” ship went down, killing 1,513 people. Drew said then that no matter what career accomplishments he achieved, he would always be remembered primarily as a Titanic passenger. It was true; even today the historic disaster with its unprecedented loss of life looms large in the human imagination.

Famed ocean explorer Robert Ballard and colleagues must have been deeply affected by the same oddly silent yet profound darkness of the ocean depths when they first spotted Titanic’s eerie sunken remains, barely visible on the deep ocean floor 73 years later. Ballard, president of the Sea Research Foundation’s Institute for Exploration, led the expedition that first located and mapped the sunken Titanic remains in 1985. So, when Ballard worked with Tim J. Delany, a former Disney Imagineering designer, to develop a new exhibit to commemorate Titanic at the Mystic Aquarium, they wanted blackness to be the first sensation that visitors experience. The new exhibit, called Titanic–12,450 Feet Below, opened on April 12 this year, and is dedicated to those lives lost on Titanic’s fateful maiden voyage.

The exhibit allows visitors to imagine what it’s like to suddenly see an iceberg appear in the dark. They can go down into a recreation of the ship’s engine room. They can see a replica of a typical passenger’s stateroom. They can even see a replica of the telegraph room where two Marconi wireless operators spent the evening sending greetings from wealthy passengers to their envious friends and later desperately tapped out distress messages on the same frequency. They can also

Rediscovering Titanic a Century Later

by Peg Van Patten

An advertisement on tin for the historic doomed ship, touted for its enormous size and elegant accommodations.

Imagine an iceberg like this looming out of the darkness, from the ill-fated Titanic’s lookout tower, or through the eyes of a small sleepy boy being lowered into a lifeboat.

continued on next page
imagine what it’s like to be an ocean explorer when they climb down into a simulation of Alvin, the submersible vehicle owned by Woods Hole Oceanographic Institution, which explorers manned during the Titanic discovery expedition.

“It is designed to capture the moment of discovery that only access to the actual discoverer’s insight and vision can deliver” said Delany. “Working hand-in-glove with Bob Ballard and Sea Research has enabled us to create something that both adults and children will find thrilling, immersive, interactive, experiential and memorable. Titanic – 12,450 Feet Below takes you there.” Delany said. Putting the drama of the event together with the high technology used by ocean explorers is the key to understanding the excitement of the discovery, he said.

“12,450 feet below is a real place, and also a place in your imagination,” the exhibit signage reminds visitors.

“We can tell the story in effective and powerful ways without desecrating the site” Ballard said. Pairs of shoes in the ocean sand that the Ballard crew saw amidst the Titanic’s debris, for example, were profoundly symbolic of the real passengers and crew who once wore them. Now a replica of shoes in the sand is included in the exhibit.

“Where are Jack and Rose?” a teen visitor asked friends, tongue-in-cheek. She knew that the two romantic movie characters in the blockbuster Cameron flick were fictional depictions of people of the period, but the exhibit’s bigger than life portraits of some of those truly lost that night put real human faces on the tragedy. Remembering them is a triumph of the human spirit, as were the lives of survivors like Drew. Disasters tend to elicit examples of both bravery and cowardice, and a range in-between from the people unexpectedly caught in them. The fate of real people and families lost is difficult to contemplate, yet makes you think what you might have said or done in their shoes. Most passengers were not told what was happening initially to avoid panic (it didn’t), a practice which has changed in crisis communication now.

The new exhibit, by design, does not include any artifacts retrieved from Titanic’s wreckage. Ballard and the Sea Research Foundation prefer to think of the wreck as an underwater museum that is also sacred ground, a graveyard. “We wanted to bring back the memory of Titanic and also make the point that the deep sea is the largest museum on earth,” Ballard said in a press conference at the exhibit opening. Ballard sees conserving and protecting such sites in the ocean, as more of it is explored, as a high priority.

The Titanic–12,450 Feet Below exhibit, sponsored by the United Technologies Corporation, is part of a larger renovation of The Ocean Exploration Center underway at the Mystic Aquarium.
When she was in high school, Sandra Shumway, now a research professor in marine sciences at the University of Connecticut at Avery Point, attended (and won) the State Science Fair at MIT. At the fair, her work was judged by scientists from the Woods Hole Oceanographic Institute. One judge left a long note by her project encouraging her to keep at it.

“Come visit Woods Hole!” he wrote, promising to meet with her to discuss her work. His support helped her to “understand the importance of the mentoring process, and what a little encouragement can do for a kid,” Shumway said.

When Shumway’s colleague Dianna Padilla, a professor of marine ecology at Stony Brook University, recently approached her with a student who needed her help, Shumway took this opportunity to pass the spirit of mentoring on to a new young scientist and “give back to the scientific community.”

The young woman in need was Samantha Garvey, then a 17-year-old student at Brentwood High School on Long Island, who gained national acclaim for becoming a semifinalist in the prestigious Intel Science Competition, even as she faced a formidable personal struggle. Both of Garvey’s parents were injured in a car accident last year that left her mother, a nurse’s assistant, unable to work. It became impossible for the family to pay rent and on Dec. 31, 2011, they were evicted from their home, forced to relocate to a homeless shelter.

Though she did not win the Intel contest, participation in the competition, while dealing with the challenge of homelessness, brought Garvey a flurry of national attention. She received an invitation to the White House Science Fair and had a seat at President Obama’s State of the Union Address. Ellen Degeneres interviewed her on her daytime talk show. Her picture appeared on the cover of Newsday magazine. And she won a $50,000 scholarship from AT&T—which Garvey hopes to put toward her college tuition—and a home for her family.

Leading up to all this, Garvey conducted two-and-a-half dedicated years of research on ribbed mussel predation in Padilla’s lab at Stony Brook. Padilla hoped to bring her and some classmates to the 2011 annual National Shellfisheries Association (NSA) meeting with money from a Toyota TAP-ESTRY Grant, an award offered yearly by Toyota Motor Sales, USA to science teachers. Rebecca Grella, Garvey’s science teacher and a Ph.D student of Padilla’s, won the grant in 2010.

Shumway is a past-president of the NSA, currently serves as editor of the Journal of Shellfish Research, and is the NSA conference manager. She wasted no time in securing a place for Garvey and her classmates at the NSA annual meeting in Baltimore in March, 2011.

“Facilitating participation of undergrads at a professional conference is rare,” said Shumway, “but it was nice to see a young, enthusiastic scientist. It was good for everyone.”

The process came with its share of difficulties. Padilla and Shumway faced piles of paperwork and waivers in securing hotel accommodations and appropriate supervision for minors on the trip to Baltimore, but both women agree that their efforts were undoubtedly worthwhile.

At the meeting, Garvey presented her findings about how ribbed mussels from Long Island Sound respond to the presence of an invasive and predatory Asian shore crab species by growing thicker shells. She shared her poster with the group of graduate students, post-docs and scientists.

“She did a remarkable job interacting with grad students and scientists, and exhibited great poise and self-confidence” Shumway said of her participation in the meeting.
Such a remarkable job, in fact, that Shumway facilitated an invitation from the NSA for Garvey and her high school science teacher Rebecca Grella, who has also played a tremendous role as a scientific mentor to Garvey, to attend the 2012 annual NSA meeting in Seattle in April.

“It is a huge deal for a high school student to be invited by a professional organization,” said Shumway, “and the first time an undergrad has been both invited and sponsored by NSA.”

Padilla credits the opportunity to answer and ask questions of her scientific peers during the earlier meeting as an important factor in Garvey’s success.

“The NSA is very welcoming, and they engage students in the scientific conversation,” said Padilla. “Questions asked by other scientists lead her to formulate her next study.” Simply being in the midst of established scholars, “seeing other studies, learning about other researchers, hearing questions that others were asking,” was helpful and encouraging for Garvey, Padilla said.

In fact, Padilla thinks Garvey’s involvement with the NSA “absolutely played a role in her being chosen as an Intel semifinalist.”

After the meeting, Padilla paid for Garvey’s one-year membership to the NSA, which included a subscription to the *Journal of Shellfish Research*. Though she said it is also “unusual to see high school student involvement in peer-reviewed literature,” Shumway “anxiously awaits a manuscript for publication from Samantha,” about her work with ribbed mussels.

The NSA, in turn, has benefitted from the extensive press coverage Garvey received after becoming an Intel semifinalist. “She’s done as much for NSA as we’re doing for her” Shumway said.

Shumway recalled seeing an NSA hat and mug peek out from behind Garvey in a video from the White House Science Fair that was aired on national television and on the Internet, and Sam’s story highlighted ABC and NBC evening news casts.

According to Shumway, members of the NSA are also pleased with Garvey’s participation.

“It encourages other students to see a success story like Sam who broke down boundaries and limitations.”

Garvey’s success, and ability to tell her story to the world, had even more far-reaching benefits beyond the NSA.

“She is an ambassador for shellfish research,” said Padilla. “Her work put shellfish research into the spotlight.”

Researchers everywhere can delight in having a new, bright, young spokeswoman, and both the University of Connecticut and Stony Brook University can share in the fortune of having ties to Garvey, Padilla said.

“She has really used this opportunity to convey her science and also illustrate the importance of good teachers and mentors.”

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**Mentor Sandra Shumway is working in her colorful office at the University of Connecticut’s Department of Marine Sciences at Avery Point in Groton.**

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**About the Author:**

Charlotte Kading was a student in Greg Stone’s newswriting class at the University of Connecticut, Avery Point, when she wrote this article. She is an English major in her junior year. Charlotte, who wants to pursue a career in science writing, is also currently a research assistant in Hans Dam’s plankton ecology lab.

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**Editor’s note:**

Samantha Garvey told news reporters she would rather read the *Journal of Shellfish Research* than *Glamour* magazine! Her family is in a new home.
Rain Gardens are really catching on—especially since the Connecticut NEMO program and its collaborators have offered training for landscapers, designers, maintenance care providers and volunteers.

What are they? Rain gardens are depressions in the landscape with plantings which are designed to capture stormwater runoff from roofs, roads, and compacted soils. The water is collected, then allowed to absorb into the soil. The result is less pollution to Long Island Sound and local waterways, and some of the water is used to nourish a lovely collection of native plants.

Those who come for the training have a first-hand experience by helping to create an actual rain garden. Mike Dietz, Connecticut NEMO coordinator and Connecticut Sea Grant Extension educator, leads the rain garden training. The training usually takes a day and a half. A development grant from Connecticut Sea Grant recently provided funds for rain garden design, materials, and installation for a demonstration garden at the Kelly Middle School in Norwich, Connecticut.

The experience is not complete when the garden installation is, because the trainees leave with the knowledge to create similar gardens for their own homes, businesses, or municipalities.

Soon, the program plans to offer a smart phone app to help users plan their rain gardens. David Dickson and Dietz, who are working on it, say the app will be available in the fall of 2012. It will assist users in selecting a proper site, sizing the garden, and selecting plants.

For more about the rain garden program, visit http://nemo.uconn.edu/raingardens or contact michael.dietz@uconn.edu.
OpSail 2012  Photo Gallery

It was a glorious day when Southeastern Connecticut celebrated its maritime heritage with the 3-day OpSail event, which also commemorated the 200th anniversary of the War of 1812. Nancy Balcom, Connecticut Sea Grant associate director, took these pix on July 7 in New London and Niantic. Of course the exception is the one she appears in, which was taken by Louis DiGiusto, a Coast Guard Auxiliary member.

Top: The U.S. Coast Guard barque, Eagle
Bottom: Nancy and Captain Vojvodich

Top: Climbing up the rigging
Bottom: Our flag still waves!