

# MAKING WAVES

at the Darling Marine Center • December 2012



## Diving for Deep Water Corals in South American Fjords

Tens of thousands of years ago *Desmophyllum dianthus* was dominant in much of the deep ocean, living at depths of over 1000m. Today this beautiful coral is a rare occurrence in much of the deep sea, but it has recently been found in great abundance in the Patagonian fjords. The Patagonian fjords lie on the coast of Chile, where the Andes Mountains meet the South Pacific Ocean. Cold, nutrient-rich deep-ocean waters upwell into the fjords allowing deep-water species to live at depths shallow enough to be studied with SCUBA.

With funding from the National Geographic Society and the National Science Foundation, Dr. Rhian Waller traveled to the Huinay Scientific Field Station in Chile to dive in the fjords, to see and sample the corals, and to establish monitoring sites for a yearlong study. The primary objective of this study is to find out how *Desmophyllum* reproduces. A secondary objective is to pick three populations in different environments (two different fjords and a site close to a salmon farm), to see how environmental factors affect reproduction.

Accompanied by Chris Rigaud, UMaine DSO, and Dan Genter from the Huinay station, Rhian jumped into the icy fjord waters. Specimens were collected for reproductive analysis, transects were photographed, data loggers deployed (to measure temperature, salinity and light), and sampling regimes established. Dan will dive at the site closest to the field station throughout the year to collect and preserve *Desmophyllum* specimens. Rhian will return in 2013 to collect the data loggers and specimens and to dive once more among the unique corals.

In addition to funding the coral research in the Patagonian Fjords, The National Geographic has named Rhian a "National Geographic Explorer." National Geographic Explorers provide the world with scientific breakthroughs and discoveries that inspire people everywhere to appreciate our planet.



*Desmophyllum dianthus.*

*And here they were, dense mats of corals under-hanging the boulder, all with their tentacles out – whites, oranges, reds and pinks. Hundreds of them – on this boulder and that boulder – with stretches of pink coralline algae in between. Even with science to be done, there was time for a few moments of pure awe at these deep-sea creatures, living shallow enough for me to reach out my hand and touch their tentacles.*

~ Dr. Rhian Waller



Dan Genter, Rhian Waller and Chris Rigaud at the Huinay Scientific Field Station in Chile.

Read Rhian's Explorer Bio at [www.nationalgeographic.com/explorers/bios/rhian-waller](http://www.nationalgeographic.com/explorers/bios/rhian-waller).

Listen to Rhian discuss her work at <http://video.nationalgeographic.com/video/specials/in-the-field-specials/waller-deep-sea-coral>

## Please Sit Close to a Squid

"Please sit close to a squid" said the note on the blackboard as students filed into class. Dr. Joe Thompson would give the day's lecture on cephalopods and he placed several finger bowls, each with a single small squid, on the lab benches. On sabbatical from Franklin & Marshall College, Joe spent the fall semester as a Visiting Scholar at the DMC.

As an experienced invertebrate zoologist with a specialty in cephalopod biology, Joe was a great addition to the marine invertebrate course taught by Dr. Kevin Eckelbarger each fall. He lectured to students on this fascinating group of animals, assisted with invertebrate collections during field trips, and brought some exotic freshwater invertebrates, collected at local ponds, for the students to contrast with the marine species they've been studying.

Joe's first visit to the DMC was in 2005 and he's been coming back every summer since. Accompanied by his wife and three kids, and an intern or two, Joe makes the annual trek from Pennsylvania to Maine to study squid. During his first summer at the DMC, Joe and the "Squid Squad" first looked at the kinematics of jet propulsion in larval, juvenile and adult longfin squid, *Doryteuthis pealei*, and concurrent developmental changes that occur in mantle muscle cell structure and physiology. This led to the development of a mathematical model that described how muscle cell function varies across the muscular body walls of hollow, cylindrical marine invertebrates. Working with Dr. Bill Kier, University of North Carolina-Chapel Hill, the Squid Squad has spent the last three summers testing the model with live squid caught off the dock or in the surrounding area.



The Thompson Family: Sue, Ian, Joe, Claire and Sophie.

Joe's primary research goal for this sabbatical is to develop a technique to measure the contractile properties of individual invertebrate muscle cells. Such techniques exist for vertebrate and arthropod cells, but Joe is working with muscle cells that are 1/1000 the size, making the task much more challenging. Drawing from mammalian cardiac research, Joe hopes to employ tiny sensors to measure the contractile force of squid and polychaete muscle cells.

The Thompson family has readily adapted to a longer than usual stay in Maine. Ian, Claire and Sophie are enrolled in the South Bristol School (grades 4, 2 and K) and have loved the school since day one. Joe's wife, Sue Dodge, on leave from her job as a middle school science teacher, has been working part time on a science curriculum development for grades 8-12. She is curating bioinformatics-related lessons for high school science and

computer science classes on the Bioinformatics Activity Bank website [teachingbioinformatics.fandm.edu](http://teachingbioinformatics.fandm.edu), as well as working with Creative Curriculum LLC on creating curricular materials to accompany the Food For 9 Billion project, a yearlong series of radio and TV news reports about the challenges of feeding the world in a time of environmental and social change.

It's always a pleasure to have the Thompson family at DMC!

*The Darling Marine Center is the best marine lab on the planet! - Sue Dodge*

## Sampling Gear Takes the Plunge

The DMC's collection of oceanographic sampling gear now includes a remotely operated vehicle (ROV), water sampling array with CTD, and otter trawl; all are available for use by visiting investigators and visiting college groups.

The JW Fishers SeaLion-2 ROV was purchased with a \$43,495 grant from the UMaine Multiuse Equipment Initiative sponsored by President Ferguson's Office. Equipped with a high definition video camera, parallel lasers and GPS, it is suitable for benthic ecosystem surveys and assessments of marine resources.

Marine science classes from UMaine, Colby, Bates and Bowdoin Colleges have made good use of the water sampling array and CTD purchased with a 2009 grant from the National Science Foundation. Equipped with sensors to measure dissolved oxygen, chlorophyll, turbidity, salinity, temperature and depth, and three 4-liter sample bottles, the CTD array is suitable for coastal waters to 300m depth.

The new otter trawl jointly purchased by the DMC and the School of Marine Sciences has already been put to use by UMaine students and researchers surveying the finfish population in the Damariscotta River. It has also been used to collect fish samples for parasite studies and other fisheries related research.



Above: UMaine graduate student Jenn McHenry and summer interns Emily Asp (Westfield State College) and Ariel Hawkins (Tusculum College) with the new ROV.

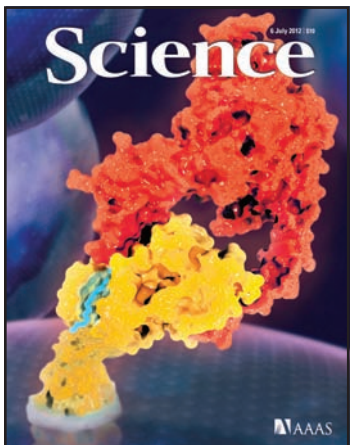


Left: Dr. Rick Wahle, Dr. Damian Brady and UMaine students retrieve the otter trawl.

Right: Dr. Mary Jane Perry and the CTD.



## RECENT PUBLICATIONS

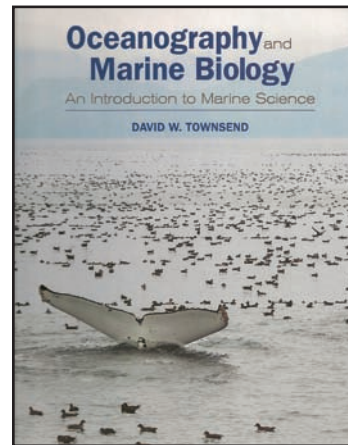


### Secret Role of Eddies Exposed in Science

It's been three and a half years since 26 researchers from 13 institutions and five countries conducted the largest, most comprehensive study of the North Atlantic spring bloom and stunning discoveries are still being combed out of the data. Most notably, a finding that knocks off the long-held belief that sunlight is the crucial element required for massive spring bloom of phytoplankton. If not sun, then what? Eddies. Huge shallow-water eddies that hold pockets of water at the seasurface thereby enhancing the sun's effectiveness to warm the waters and drive photosynthesis. Without eddies, scientists believe, the spring bloom would be delayed 2-3 weeks waiting for the sun to strengthen at the northern latitudes.

Funded by NASA and NSF, and published in *Science*, the paper reports the latest discoveries by UMaine's Dr. Mary Jane Perry and her colleagues at the Woods Hole Oceanographic Institute and the University of Washington who conducted the North Atlantic Bloom Experiment in 2008. The project successfully quantified, in three dimensions, the size and scope of the annual phytoplankton bloom and its role in the global carbon cycle.

Mahadevan, A., E. D'Asaro, C. Lee, and M.J. Perry. 2012. Eddy-driven stratification initiates the North Atlantic Spring phytoplankton bloom. *Science* 337:54-58.



### Textbook Published

UMaine School of Marine Sciences professor David Townsend is the author of a newly published textbook **Oceanography and Marine Biology** (Sinaur Associates, April 2012). Frustrated by the fact that most introductory marine science textbooks focus on either oceanography or marine biology, David put pen to paper to write a book that

merges the physical, chemical and geological characteristics of the ocean environment with marine biology and ecology, and includes historical segments highlighting famous researchers and milestones. The result is an excellent introductory marine science textbook that explores a truly unique habitat in which truly unique life forms exist. Many of the photographs in the invertebrate chapter were taken at the DMC. ISBN 978-0-87893-602-1.

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Dr. Kevin J. Eckelbarger  
Director

Tim Miller  
Laboratory Manager

Linda Healy  
Science Writer & Events Coordinator

For more information please contact us:  
193 Clarks Cove Road • Walpole, ME 04573  
207.563.3146 • dmc.maine.edu

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If you've done work at the DMC that's been published, please send the citation to our librarian at [randy.lackovic@umit.maine.edu](mailto:randy.lackovic@umit.maine.edu)



Catherine Matassa at her sampling site on Hodgson Island in the Damariscotta River estuary.

## To Eat, To Not Eat, or To Be Eaten: Prey Stuck in the Middle

You're a hungry snail. A lunch of barnacles and mussels waits on the intertidal rocks. A green crab is there, too. A hungry green crab whose next meal could be you. So what's a snail to do; risk being eaten for the sake of sustenance? Catherine Matassa, a Ph.D. student at Northeastern University, spent three months at the DMC this summer trying to assess the relative importance of such "non-consumptive" effects that predators have on prey. Catherine was searching for and testing mechanisms by which mid-trophic level organisms such as the dog whelk, *Nucella lapillus*, balance their need for sustenance with the risk of predation by green crabs, *Carcinus maenas*. She hopes that a better understanding of non-consumptive predation effects on prey will shed light on how energy is transferred between trophic levels, community structure, and ecosystem dynamics.



Dan O'Grady and Chris Maloney in the algal culture room.

## Sustainable Products from Microalgae

BioProcess Algae LLC designs, builds, and operates commercial-scale bioreactors that use the CO<sub>2</sub> (a byproduct of ethanol production) to produce microalgae for animal feed, nutritional supplements and biofuels. At company headquarters in Rhode Island, the focus is on designing and engineering the bioreactors. To develop a company presence in Maine, BioProcess Algae leased the Aquaculture Business Incubator. The focus here is on algae.

Chris Maloney, Director of Biology, heads the algal research and development team. They make use of the DMC's alga culture greenhouse and SeaCaps system to create blends of algae to suit customers' needs. With data gathered here, larger volumes of algae are then produced at a facility in Port Clyde, Maine, and delivered to partners for analysis and trials.

BioProcess Algae has partnered with Green Plains Renewable Energy Inc. in Shenandoah, Iowa. Together they've built a bioreactor that is tied directly into an ethanol plant's CO<sub>2</sub> exhaust. It has been in continuous operation since opening in October 2009 and produces a wide range of sustainable produced bioproducts derived from microalgae.



Dr. Gene Smith, Dr. Warren Riess and Dr. Kevin Crisman

## History Colleagues Write & Dive at the DMC

This summer Dr. Warren Riess, our resident maritime historian and archaeologist, welcomed two colleagues and their families to the DMC: Dr. Gene Smith, Texas Christian University (TCU), and Dr. Kevin Crisman, Texas A&M University (TAMU). It all started at the 2011 meeting of the North American Society for Oceanic History. Warren, Gene and Kevin were talking about the weather. Kevin and Gene were dismayed by Texan summer heat and manuscript deadlines. Warren, heartened by Maine's perfect climate, suggested his colleagues spend the summer at the DMC.

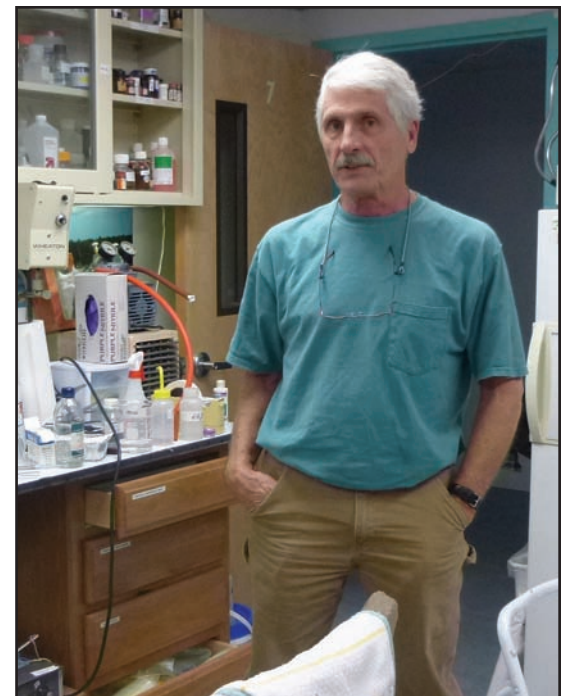
And so it was that in 2012, the DMC hosted two professors specializing in the causes, battles and shipwrecks of the War of 1812. Gene, Professor of History and Director of the Texas Studies Program at TCU, made good use of our library as he made final edits to his latest book titled "The Salves Gamble: Choosing sides in the War of 1812" (release date January 2013.) Editors told him to cut 40,000 words!

Kevin Crisman, Associate Professor of Nautical Archaeology and Director of the Center for Maritime Archaeology and Conservation at TAMU, completed a book reviewing the naval shipwrecks of the War of 1812. He and Warren also revisited a common interest – the *Defence*, an American brigantine that was used during the Revolutionary War and scuttled in the Penobscot River so as not to fall into the hands of the British. Fifteen years ago, they dove on the wreck and collected samples of the hull that a colleague in Sweden assayed for agents and degree of deterioration. They returned to the shipwreck this summer for another hull sample to reassess its condition. Knowing why and how rapidly the biota is destroying the wood are necessary as they determine the next steps in studying and possibly preserving the Revolutionary War hull.

## Long-Time Visiting Investigator Extends Stay & Collaborations

Dr. Michael Horst has been a visiting summer researcher at the DMC since the mid 1990s. As he transitions into retirement from Mercer University his teaching load lessens and his research season at the DMC lengthens. With each visit the biochemistry/molecular laboratory swells with equipment and Mike's collaborations with DMC faculty diversify.

Spionid polychaete sperm are the focus of a project with DMC Director Kevin Eckelbarger. These small worms are commonly found in shallow waters along the coast of Maine. During their reproductive season, the males transfer packets of sperm to the female that she stores in her body, for weeks or even months, until she is ready to fertilize her eggs. Kevin and Prof. Alan Hodgson, Rhodes University, South Africa, are describing unique and peculiar organelles within the spionid sperm and suspect that they play a role in energy storage. Mike and Kevin are attempting to use transmission electron microscopy and an immunogold-labelling technique to determine the chemical nature of these organelles to either support or refute the energy storage theory.



Dr. Michael Horst in the molecular laboratory.

Mike is a biochemist by training and a long-time theme of his research has been the effects of pesticides and other chemicals on invertebrates. More recently, he has delved into the molecular realm; comparing the molecular structure of chitin synthase, the enzyme that produces chitin, from "living fossils" like the horseshoe crab (*Limulus*) and the velvet worm (*Peripatus*), to more highly evolved invertebrates like the American lobster (*Homarus*) to learn about its molecular phylogeny. He's been able to trace it back 450 million years.

## DMC WELCOMES VISITING RESEARCHERS

Our **Visiting Investigators Program** draws researchers from across the country and around the world to the DMC for the summer field season. Competitive rates, helpful support staff and easy access to diverse intertidal habitats and the Gulf of Maine keep them coming back.

Graduate students who need to carry out their thesis research at a marine laboratory should apply for our **Visiting Graduate Student Awards**. Each award provides housing, laboratory space, aquaria, SCUBA support and boat rentals valued at \$3400.

Senior-level faculty and researchers who can collaborate or interact with resident faculty and students in a mutually beneficial way during the academic year are invited to apply for our **Visiting Scholars Program**. Recipients receive free furnished housing and office space.

For more information about our programs, please visit our website, [dmc.maine.edu](http://dmc.maine.edu).



Wayne Chadwick and the oak tree by the library.

## Wayne Retires at the End of the Year

Wayne Chadwick will retire from his 25-year career as Buildings & Grounds Keeper at the DMC on December 31st. Wayne has lived his entire life in Bristol, Maine. For 17 years he worked for the U.S. Navy on Rutheford Island building sonobuoys. The department relocated to the Caribbean, but Wayne didn't follow. Instead he turned to the classified ads in the Lincoln County News, read of an opening at the Darling Marine Center, and we've been lucky enough to have him here ever since! Wayne's commitment to the DMC and kindness to the people who work here was honored in 2010 when he received the University of Maine's Outstanding Employee Award.

Wayne seems to stumble a bit when asked what he's going to do in retirement. "Sit in a rocking chair and watch the birds, I guess," he finally responds. We're sure he'll be a bit more active than that, and are willing to bet that "Grampy" will spend lots of time with his grandkids and his gardens will be as bountiful as ever!

*Happy Retirement Wayne!*

## South Bristol School and the DMC - 12 Years Together

Mary Snow, 3rd/4th grade teacher at the South Bristol School, was one of the first teachers to take advantage of the DMC's K-12 Education Program when it began 12 years ago. Marine science and field trips to the DMC have been an important component of her science curriculum ever since.

Ecosystems, biodiversity and evolution are the primary topics of study in Mary's 3rd/4th grade science class. As the students live a maritime community and the DMC is so accessible, it makes sense to teach these concepts within the context of the marine realm.

Lili Pugh, DMC K-12 Coordinator, ensures the field trip activities dovetail with Mary's classroom assignments. Lili's goal is to provide students a better understanding of the oceans through exposure to marine organisms, visits to the shore, interaction with scientists, and use of scientific tools and methods.

"I want the students to walk away being more aware, and able to ask more questions than they came with," she says.

The K-12 education program at the DMC began in 2000, when the Gulf of Maine Foundation hired Jan Faulkner to establish opportunities for area schools. Lili took the K-12 helm in 2011 and in the past year she has hosted well over 500 student visits to the DMC. Though the majority of visits are from schools within the immediate area, Lili welcomes schools from farther afield and often works with home-schooled students as well. Programs can be customized to target specific curriculum needs and funding from the Edward A. Meyers Marine Conservation Fund helps defray the cost of boat trips for schools within the watershed. For more information about the program, contact Lili at [anneliese.pugh@maine.edu](mailto:anneliese.pugh@maine.edu).



Mrs. Snow's 3rd/4th grade class of South Bristol School at the waterfront.



Dr. Bernie McAlice and a dish of copepods in the Marine Culture Laboratory classroom.

## Dr. Bernie McAlice Honored with Plaque

A plaque has been hung in the flowing seawater classroom in the Marine Culture Laboratory to honor Dr. Bernie McAlice. Based at the Darling Marine Center from 1967 to 1993, Bernie advised and mentored countless students and taught many graduate-level courses on topics ranging from biological and physical oceanography to marine zooplankton during his tenure as University of Maine Professor of Oceanography and Marine Biology. As Professor Emeritus, Bernie continued to teach on a volunteer basis; assisting and inspiring undergraduate and K-12 programs throughout the year.

The Marine Culture Laboratory was completed in 2001. In this flowing seawater classroom, Bernie has shared his love and respect for the natural world, exposing the secrets and beauty of microscopic marine life to students of all ages.

*Thanks, Bernie!*

## Half Shell Celebration Benefits Marine Education

The Pemaquid Oyster Festival is an annual event in the town of Damariscotta when the waterfront parking lot morphs into a celebration of the oyster. In addition to music and dancing there are oysters – LOTS of oysters. This year, 14,770 oysters were shucked and slurped from their half shell, graced by only their natural liquor, or any variety of sauces and condiments.

The DMC and the Damariscotta River oyster industry have strong ties. In the 1970's Dr. Herb Hidu, his colleagues and graduate students at the DMC developed the techniques to culture and grow the American Oyster in the clean cold salty waters for the Damariscotta River estuary. In the decades since the river has supported a \$2 million industry. Truly something to celebrate!

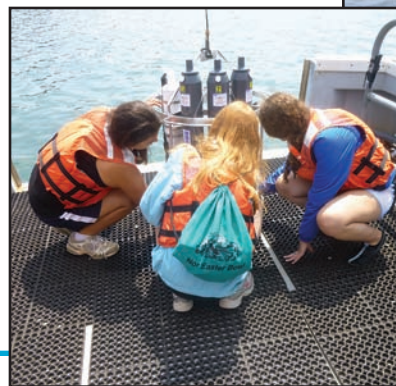
Proceeds from this fun festival go entirely to the Edward A. Meyers Marine Conservation Fund that awards grants to area educational and conservation organizations. The DMC once again received funds to support our K-12 program. The funds defray the cost of DMC field trips and research cruises to schools within the Damariscotta River watershed. Many thanks to the festival organizers and to the Edward A. Meyers Marine Conservation Fund.

## DIVE IN... TO MARINE SCIENCE

Marine science captures the imagination of many students. But what does one really study as a marine science major and what are the career options? To find out, you have to **Dive In**. Dive In is a three-day program for college-bound seniors interested in studying marine science. At the DMC, students explore the fields of marine biology, ecology, oceanography, scientific diving, remote ocean sensing, computer modeling, and aquaculture on foot, by kayak, and aboard the R/V Ira C. with faculty and staff of UMaine's School of Marine Sciences.

Dive In 2013 is scheduled for August 12-14.

[dmc.maine.edu/divein](http://dmc.maine.edu/divein)





Above: Dr. Jeff Cornwell and Senior Technician Mike Owens with a box corer used to collect undisturbed sediment samples from around the aquaculture sites. Below: Dr. Roger Newell collecting mussels from the Pemaquid rafts in Clarks Cove. Photos courtesy of R. Newell.

## Predicting Spatial Impacts of Bivalve Aquaculture

Researchers from the University of Maryland joined Maine colleagues at the DMC to characterize the effect of bivalve aquaculture on the surrounding ecosystem. The perceived adverse environmental consequences of shellfish aquaculture on public water are often the greatest impediment to the expansion of the industry. Roger Newell, Larry Sanford and Jeffery Cornwell, all from the Horn Point Laboratory in Maryland, teamed up with Carter Newell and John Richardson, co-owners of Pemaquid Mussel Farms, and SMS/DMC research professor, Damian Brady, to quantify environmental impacts of shellfish farms.



With funding from National Sea Grant, work began in 2011. The particulate waste (feces and pseudofeces) generated from shellfish farms in midcoast Maine and the Chesapeake Bay was quantified. The flow rates of tides and currents, the settling rates of particulate matter, the accumulation rate of organic carbon, and the inorganic nutrient availability in the bottom sediments were also measured at each site. The data were compiled and entered into a mathematical model to illustrate any relationships between dispersal and breakdown of the particulate waste relative to physical and biogeochemical processes at various distances from the shellfish farm.

2012 marked the second field season, and the chance to develop the predictive capability of their model and receive modeling input from Damian. The team measured the same processes at two shellfish farms close to the DMC in the Damariscotta River: the shallow-water (6m) oyster farm owned by Bill Mook, and the deep-water (20m) Pemaquid Mussel Farm in Clarks Cove. The results will allow the researchers to fine-tune their model. If successful, the model will be a useful tool for selecting aquaculture sites consistent with the ideas of ecosystem-based coastal zone management.



## Lobster Symposium in Portland, Maine

As this edition of Making Waves goes to press, 150 scientists from the U.S., Canada and Norway will convene in Portland, Maine, for **The American Lobster in a Changing Ecosystem: A US-Canada Science Symposium**. The event will focus on four themes: anthropogenic and environmental stressors; foodweb dynamics; human-natural systems and ecosystem-based management; and population connectivity.

The event's organizing committee is co-chaired by Dr. Rick Wahle, UMaine's School of Marine Sciences, Paul Anderson, Maine Sea Grant, and Dr. Andrea Battison, University of Prince Edward Island. More information about the symposium is at [seagrant.umaine.edu/lobster-symposium](http://seagrant.umaine.edu/lobster-symposium).

## RAZOR CLAMS

The razor clam is an intertidal delicacy that has yet to make a broad culinary splash. The tasty bivalve has remained elusive in the shellfish market for two reasons: it is only accessible and harvestable during very low tides and it can dig fast and deep, easily avoiding capture. A team of researchers believe a ready supply of razor clams could sustain a retail/restaurant market and provide a way for shellfish growers and clam diggers to diversify their business plans. The trick will be to reliably produce the clam seed in a hatchery, and develop grow out techniques that keep the clam "fat and happy" buried in sandy sediments, protected from predators, and easily harvested.

With funding from the Northeast Regional Aquaculture Center, collaborators Paul Rawson (UMaine), Dale Leavitt (Roger Williams University), Diane Murphy (Cape Cod Cooperative Extension), Michael Devin (UMaine) and Dana Morse (Maine Sea Grant) have begun to refine and improve hatchery production of the razor clam.

On June 12, the excitement began! An unexpected spawn of the broodstock razors pushed the hatchery crew into high gear as they madly collected the fertilized eggs and got them into a larval culture tanks. A planned spawning followed two weeks later. DMC Hatchery Manager, Mick Devin and undergraduate interns Molly Flanagan (UMaine) and Chauncey Devin (Hampshire College) waited eagerly for the larvae to grow, and settle as juveniles in shallow sediment filled trays. Despite high mortality of the early post-set juveniles, tens of thousands survived.

There are now 100,000 young clams in the shellfish hatchery. These will eventually be "planted" in the Damariscotta and monitored for growth. Meanwhile the research team is pulling together a new proposal to extend the hatchery work and develop grow-out techniques.



Above: Chauncey Devin, Molly Flanagan and Mick Devin with razor clams in the shellfish hatchery. Below: Juvenile razor clams. Photos courtesy of D. Morse.



Left: Graduate student Skylar Bayer in the flowing seawater lab. Above: Skylar and summer interns Noah Oppenheim and Holly Martin on the scallop raft.

## The Scallop Fever by Skylar Bayer

In the Wahle Lab, we have been working hard to understand the reproductive ecology of the giant sea scallop, *Placopecten magellanicus*. The giant sea scallop is one of the east coast's most important commercial fisheries. Currently there is a lot of concern about how overfishing may affect future populations. Giant sea scallops are broadcast spawners – meaning that both males and females release their gametes into the water column where, with a little luck, eggs are fertilized and develop into larvae. Depleting populations of scallops dilutes gametes and makes that chance event of egg meeting sperm even less likely.

Water is not a static environment and therefore factors like flow and timing of egg and sperm release can impact the proportion of eggs that get fertilized, and in turn become larvae. During the summer spawning season we conducted a field experiment comparing fertilization success in two experimental populations of scallops we placed in the Damariscotta River, one with ten times more scallops than the other. This required conditioning and spawning female scallops in the lab, collecting the unfertilized eggs, and deploying them in small mesh chambers among the experimental populations to assess

the resultant fertilization rates. We conducted ten deployments over the course of the spawning season. Divers periodically monitored the populations to assess changes in population density and gonad condition. So far, from measurements of gonad weight, we know that the scallops in both populations spawned out between mid-August and mid-September. The job of determining the relative fertilization rates in the two groups will take hours of microscope work slated for later this fall and winter.

The project will contribute to the doctoral thesis of Marine Science graduate student Skylar Bayer, who has been working day, night and weekends with logistic support from Wahle Lab technician Charlene Bergeron, graduate student Noah Oppenheim (UMaine) and undergraduates Holly Martin (UMaine), Adam Umstead (Michigan State) and Hillevi Jaegerman (Tufts).

Skylar is head editor of StricklyFishwrap, a blog by graduate students, about graduate student life and marine science issues, [strictlyfishwrap.com](http://strictlyfishwrap.com).



## Algal Culture Techniques Workshop

The Algal Culture Techniques Workshop, hosted by the National Center for Marine Algae and Microbiota (NCMA) at the Bigelow Laboratory for Ocean Science, is geared toward graduate students, faculty, and professionals in the aquaculture and biofuels industries, the week-long workshop covers basic and advanced techniques for isolating, growing, cryopreserving, identifying, and harvesting marine phytoplankton. The workshop has proved so popular in recent years that two back-to-back sessions will be offered at the DMC in June 2013. For more information contact Brynne Kristan at [bkristan@bigelow.org](mailto:bkristan@bigelow.org).



## Developmental Biology Workshop

The Developmental Biology Teaching Workshop will be offered June 25-29 2013. The workshop helps college professors expand their laboratory curriculum with new techniques and lesson plans. Instructors Dr. Leland Johnson and Dr. Eric Cole will be joined by guest lecturer Dr. Mark Spiro, Bucknell University, PA, who will bring his expertise in plant growth and development to the workshop. Guest lecturers to the DBTW are made possible with financial support from the Society for Developmental Biology. Registration materials for the DBTW are available at: [dmc.maine.edu/coursesprofdev](http://dmc.maine.edu/coursesprofdev).



Illustration by Jonas Insinga

## Natural Science Illustration Workshop

Let your creative juices flow! Instructor David Wheeler encourages participants to experiment with new styles and mediums as they hone their observational skills and artistic talents. During this 5-day workshop, invertebrates, freshly sampled from the intertidal zone, as well as skulls, shells, and artifacts from David's personal collection serve as the primary subjects. No art experience is required. Prior participants have included high school students, teachers and professional illustrators. Registration materials are available at: [dmc.maine.edu/coursesprofdev](http://dmc.maine.edu/coursesprofdev).



## UMaine Accredited Courses

"Study nature, not books" is a well-known phrase coined by the famous naturalist Louis Agassiz. At many schools it's possible to complete a four-year degree in marine science without ever seeing the ocean, touching a starfish, or going out on a research cruise, but what fun is that? At UMaine's Darling Marine Center, undergraduate & graduate opportunities abound. Intensive May term and summer courses, and the residential Semester By the Sea program engage students in courses that use the Gulf of Maine and the Damariscotta River Estuary as the primary classroom. Reading is, of course, required.

### Semester By the Sea, Fall 2013

**Semester by the Sea (SBS)** is a different kind of learning experience that draws adventurous students to the DMC for the fall semester. Each day a single intensive and hands-on course is offered. Lectures, labs and field trips revolve around the tides. Motivated students keenly interested in the marine realm and considering graduate school or a professional career in the marine sciences will find SBS an invaluable experience. Courses include:

- ◆ Marine Ecology
- ◆ Biology of Marine Invertebrates
- ◆ Human Impacts on the Ocean
- ◆ Zooplankton & Ichthyoplankton
- ◆ Introduction to Research Diving
- ◆ Capstone/Independent Research

More information about the DMC program can be found at [dmc.maine.edu/sbs](http://dmc.maine.edu/sbs).



### 2013 May-term & Summer Courses

- ◆ **Invertebrate Life History & Functional Morphology**  
May 15-29
- ◆ **Estuarine Oceanography**  
May 16-30
- ◆ **MATLAB for Marine Sciences**  
May 21-June 6
- ◆ **Archaeology of Shipwreck Sites**  
May 22 - June 7
- ◆ **Polar Marine Ecology**  
June 3-14
- ◆ **Polar Marine Ecology: Arctic Field School**  
June 30- July 14
- ◆ **Calibration & Validation for Ocean Color Remote Sensing**, July 8-August 2

Room and board are available at the DMC for all May-term and summer courses. Full course descriptions and registration information is available at [dmc.maine.edu/coursesUM](http://dmc.maine.edu/coursesUM).



## VISITING COLLEGE FIELD TRIP PROGRAM

The DMC makes it easy for faculty to add a hands-on field component to a regular classroom syllabus. A typical field trip includes: half-day sampling cruise aboard the R/V Ira C., intertidal collecting trips, access to flowing seawater classroom with microscopes for specimen identification, two nights lodging and meals. Custom field trips can be arranged to accommodate extended stays or specific syllabus goals. A weekend field trip for 15 students and one professor costs less than \$2,400. More information about the Visiting College Field Trip Program can be found at [dmc.maine.edu/viscolleges](http://dmc.maine.edu/viscolleges).



*A salty adventure students never forget!*