

MAKING WAVES

at the University of Maine Darling Marine Center



New Research Programs at the DMC

Dr. Collin Roesler & Dr. Jeff Runge, new faculty at the University of Maine School of Marine Sciences, are establishing research programs at the DMC.



The Roesler lab aboard the R/V Argo on the Penobscot River (left to right): Mike Sauer, Susan Drapeau, Dr. Collin Roesler, Liz Hoering and Heidi Franklin.



Dr. Collin Roesler describes herself as an environmental optical oceanographer. Since 2004, she and her colleagues have been measuring the flow of dissolved and particulate carbon through the Penobscot River watershed. With strategically moored optical and physical sensors, they monitor and track carbon flux out of tributaries, down the river, and ultimately into the Gulf of Maine.

The researchers suspected that the land-sea carbon connection would be significant, but were amazed to learn that the Penobscot River delivers an amount of carbon equivalent to 10% of all the carbon delivered to the Gulf through the Northeast Channel. As the Penobscot is one of 25 rivers draining into the Gulf, and second only in discharge to the St. John, their findings suggest the land-sea carbon connection is indeed notable.

In quantifying the carbon flux from watershed to gulf, the team expected to find low carbon levels during periods of high precipitation and high discharge; assuming the carbon signal would be

diluted. The exact opposite is true—the more water in the system, the more carbon. They also hypothesized that carbon would be transported quickly through the system during periods of high discharge, with little time for loss or transformation. Again, the exact opposite appears to hold. During periods of high discharge more than 50% of the carbon found in the upper watershed is lost and never makes it to the Gulf. Interestingly, most of the carbon transformation occurs at a single geographic point in upper Penobscot Bay, at the Frankfort Flats.

This of course leads to more questions. What is happening to the carbon? Is biology, chemistry or physics causing the drastic reduction? And what is so special about that location? With funding from NASA and the Office of Naval Research for another two, and possibly five, years Collin and her colleagues at the UMaine School of Marine Sciences, Bigelow Laboratory for Ocean Sciences, USGS and WET Labs hope to find answers to these questions.

Dr. Jeff Runge is an oceanographer whose research focuses on the role of zooplankton in marine food webs. He examines the affect of food supply, temperature and ocean physics on zooplankton populations and then collaborates with physical oceanographers to create 3-dimensional models integrating zooplankton production, larval fish survival and recruitment to the fishery. This analysis illustrates the critical role zooplankton productivity plays in marine ecosystems and provides insight to fisheries managers about the environmental influences on fish populations.

Jeff has a unique, joint position with UMaine School of Marine Sciences and the Gulf of Maine Research Institute (GMRI) in Portland, ME. In addition to his research at GMRI, Jeff now teaches a zooplankton and ichthyology course in the Semester by the Sea program. He plans to establish a graduate research program in zooplankton and a long-term sampling regime at the DMC to which undergraduates in his course would contribute.



SBS Offerings Perfect for Graduate-Track Undergrads

The Semester by the Sea program is known for its hands-on, field-oriented courses which immerse undergraduate students in marine science. The program is especially useful for students interested in pursuing a graduate degree. The courses are more in-depth, and there is ample opportunity to conduct independent research and develop working relationships with faculty. The SBS program is always evolving; courses change to meet the academic and professional needs of students.

This fall, a new course was added to the SBS line-up: Zooplankton and Ichthyoplankton in Marine Ecosystems. Taught by Dr. Jeff Runge, the zooplankton course adds a water-column component to the largely intertidal and benthic emphasis of current SBS courses. Lectures focusing on biodiversity, trophic interaction, fish recruitment and the effect of climate change on pelagic ecosystems are augmented with laboratory experiments and sampling cruises aboard the R/V *Ira C.* where students become familiar with plankton nets and hydrographic gear.



The SBS seminar course was updated and improved in 2007. The overall goal of the course is two-fold: to highlight the interconnectedness of all the SBS courses and to help prepare students for graduate school and careers in marine science. Mary Jane Perry and Annette deCharon introduced a technique called “concept mapping” to help achieve both goals. SBSers used concept mapping to make connections between organisms, habitats, maritime history and human impacts on the ocean—recurrent themes in all SBS courses. They also had the students use concept mapping to examine their life’s experiences, the people and places who and that have influenced them, and to chart a course for future endeavors.

For more information about the SBS program and application materials, go to: www.dmc.maine.edu/sbs.html

For more information about concept mapping, go to: http://cosee.umaine.edu/concept_maps.php

Above: SBS student Jenn Fortier prepares a Niskin bottle. Below: Rebecca Jones and Nick Record deploy a plankton net.

Recent Publications

- Annis, E.R., L.S. Incze, N. Wolff and **R. Steneck**. 2007. Estimates of *in situ* larval development time for the lobster, *Homarus americanus*. *J. Crustacean Biology* 27(3):454-462.
- Book, J.W., **H.T. Perkins**, R.P. Signell and M. Wimbush. 2007. The Adriatic Circulation Experiment: Winter 2002/2003 Mooring Data Report: A Case Study in ADCP Data Processing. NRL/MR/7330-07-8999. U.S. Naval Research Laboratory, Stennis Space Center, MS 39529-5004.
- Connell, L.B., S.P. MacQuarrie, **B.M. Twarog**, M. Iszard and V.M. Bricelj. 2007. Population differences in nerve resistance to paralytic shellfish toxins in softshell clam, *Mya arenaria*, associated with sodium channel mutations. *Mar. Biol.* 150:1227-1236.
- Curry, K.J., R.H. Bennett, **L.M. Mayer**, A. Curry, M. Abril, P.M. Biesiot and M.H. Hulbert. 2007. Direct visualization of clay microfabric signatures driving organic matter preservation in fine-grained sediment. *Geochimica et Cosmochimica Acta* 71:1709-1720.

- Eckelbarger, K.J.** 2007. Marine Station. In: Encyclopedia of Tidepools and Rocky Shores, MW Denny & SD Gaines, eds., University of California Press, Berkeley.
- Floge, S.A.** and **M.L. Wells**. 2007. Variation in colloidal chromophoric dissolved organic matter in the Damariscotta Estuary, Maine. *Limnology and Oceanography* 52:32-45.
- Halfar, J., **R. Steneck**, R. Schöne, G.W.K. Moore, M. Joachimski, A. Kronz, J. Fietzke and J. Estes. 2007. Coralline alga reveals first marine record of subarctic North Pacific climate change. *Geophysical Research Letters* 34:L07702.
- Hughes, T.P., M.J. Rodrigues, D.R. Bellwood, D. Ceccarelli, O. Hoegh-Gulberg, L. McCook, N. Moltschanivskyj, M.S. Pratchett, **R.S. Steneck** and B. Willis. 2007. Regime-shifts, herbivory and the resilience of coral reefs to climate change. *Current Biology* 17:1-6.
- Jumars, P.A.**, **K.M. Dorgan**, **L.M. Mayer**, B.P. Boudreau and B.D. Johnson. 2007. Physical constraints on infaunal lifestyles: May the persistent and strong forces be with you. pp. 442-457. In: W. Miller, III, eds.. *Trace Fossils: Concepts, Problems, Prospects*. Elsevier, Amsterdam.



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NEW WEBSITES

UMaine School of Marine Sciences has a redesigned website with up-to-date information on undergraduate and graduate degree programs, course offerings and research directions. The new website is an outstanding resource for prospective students.

WWW.UMAINE.EDU/MARINE

COSEE-Ocean Systems has a new home on the world wide web. The new website includes tools to help teachers bring ocean science into the classroom and valuable links to scientific organizations focusing on ocean research and climate change.

[HTTP://COSEE.UMAINE.EDU](http://COSEE.UMAINE.EDU)

A Month in the North Pacific is Kathy Hardy's blog from a recent cruise aboard the R/V *Thomas G. Thompson* to the subarctic Pacific. The blog describes not only the science (role of copper in the iron uptake systems of marine phytoplankton), but also the day-to-day adventures and tribulations of conducting research at sea. The blog originally appeared on the website of the *Village Soup* newspaper, Rockland, ME.

WWW.RESEARCHCRUISE.BLOGSPOT.COM

Sea Grant Publications

Included in the list of publications produced annually by Maine Sea Grant are the following fact sheets by Dana Morse, Sea Grant Extension Agent based at the DMC.

Overwintering of Eastern Oysters: Guidance for Small-Scale Growers. MSG-E-06-03.

Field Trials of 4" Rings in the Inshore Scallop Fishery of the Gulf of Maine. MSG-E-07-07.

Electronic versions of these publications are available at www.seagrant.umaine.edu.

Hard copies of these papers are available by contacting:

Maine Sea Grant College Program
5784 York Complex
University of Maine
Orono, ME 04469-5784
(207) 581-1435

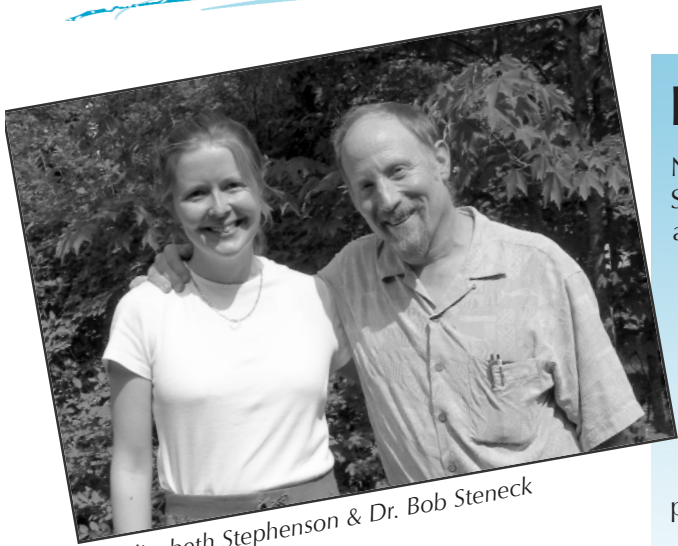


Linda Schick retired in June after 33 years of work at the DMC, primarily as a researcher and laboratory manager for Dr. Larry Mayer. During her time at the DMC, Linda proved to be an indispensable analytical chemist for the Mayer lab; coauthoring 29 papers and mentoring countless graduate students and interns. She was also instrumental in developing laboratory safety procedures at the DMC and served on numerous Boards in the community.

Mayer lab students and colleagues—past and present—were on hand for the farewell celebration. Linda and husband Dan have since moved to Oregon to be near kids and grandkids. We wish the Schicks the best of luck and hope they visit us on the east coast often!

Recent Publications, continued

- Jumars, P.A.** 2007. Habitat coupling by mid-latitude, subtidal, marine mysids: Import-subsidized omnivores. *Oceanogr. Mar. Biol. — Ann. Rev.* 45:89-138.
- Mayer, L.M., L.L. Schick, M. Allison, K. Ruttenberg and S. Bentley.** 2007. Marine vs. terrigenous organic matter in Louisiana coastal sediments: The uses of Bromine: organic carbon ratios. *Marine Chemistry* 107:244-254.
- Paul, J., C. Scholin, G. Van Der Engh and **M.J. Perry.** 2007. *In Situ* Instrumentation. *Oceanography* 20(2):58-66.
- Steneck, R.S., R.H. Bustamante, P.K. Dayton, G.P. Jones and A.J. Hobday.** 2007. Kelp forest ecosystems: Current status and future trends in Polunin NVC (ed) 2007 Aquatic ecosystems: Trends and global prospects. Cambridge University Press.
- Steneck, R.S.** and P. Martone. 2007. Calcified algae. pp. 21-24. In: Denny, M. and S. Gaines, *Encyclopedia of Tidepools and Rocky Shores*. Univ. of California Press.
- Steneck, R.S.** 2007. Gulf of Maine: A case study. pp. 199-202. In: Hunter, M.L., Jr. and J. Gibbs, *Fundamentals of Conservation Biology*. 3rd Ed. Blackwell Publishing.
- Teague, W.J., D.S. Ko, G.A. Jacobs, **H.T. Perkins**, J.W. Book, S.R. Smith, K.-I. Chang, M.-S. Suk, K. Kim, S.J. Lyu and T.S. Tang. 2006. Currents through the Korea/Tsushima Strait: A review of LINKS observations. *Oceanography* 19(3):50-63.
- Townsend, D.W., A.C. Thomas, **L.M. Mayer**, M. Thomas and J.A. Quinlan. 2006. Oceanography of the Northwest Atlantic continental shelf. In: *The Sea*, Vol. 14A, *The Global Coastal Ocean* (Robinson, A.R. and Brink, K.H., eds.), pp. 119-16.
- Wagai, R. and **L.M. Mayer.** 2007. Sorptive stabilization of organic matter in soils by hydrous iron oxides. *Geochimica et Cosmochimica Acta* 71:25-35.



Elizabeth Stephenson & Dr. Bob Steneck

Dual Degree Program a Big Hit!

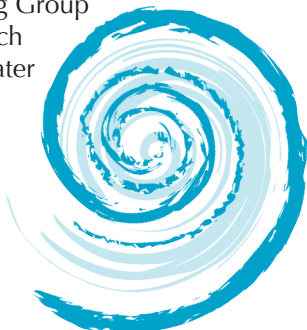
Now in its 5th year, the dual M.Sc. degree in Marine Policy and Marine Sciences program is churning out grads with the skills that are immediately marketable in the work place and in research. This year, three SMS grad students based at the DMC completed dual degrees: **Elizabeth Stephenson** (left), **Susie Arnold** (below) and **Curt Brown** (right).

The dual degree program is intended for students interested in the application of science to public policy in government agencies, non-governmental organizations or industry. The course of study leads to two master's degrees: one in marine science (specializing in oceanography, aquaculture or marine biology) and one in marine policy. More information www.umaine.edu/marine/programs/dual.php.

Elizabeth Stephenson began her graduate studies in 2002, barely a year after the invasive Asian shore crab (*Hemigrapsus sanguineus*) was first detected in Maine waters. She was thus presented with the unique opportunity to study a bioinvasion from its beginning stages. Working with advisor Dr. Bob Steneck and Robin Hadlock Seeley of Cornell University, Elizabeth explored whether temperature may limit range expansion by this species.

Elizabeth's results suggest that the invasion is progressing much more slowly in Maine than in the southern New England and Mid-Atlantic states. The crab's range seems to be stalled at the terminus of the cold Eastern Maine Coastal Current, and rates of population growth have been slow even in the warmest, most southern locations of the state. She speculates that the summer temperatures of Maine waters are too low to allow for regular successful recruitment, but notes that a warming ocean may create a more hospitable environment for the Asian shore crab as well as other future invaders.

Elizabeth is currently working for the Maine Coastal Program, an extension of the work she did for the policy portion of her degree. She is involved in a variety of programs and projects including coordinating the Maine Marine Invasive Species Working Group and working on beach management and water quality issues.



Susie Arnold & Dr. Bob Steneck

Working with Dr. Bob Steneck, **Susie Arnold** studied the processes of coral recruitment on the reefs of Bonaire. Parrotfish and other herbivorous reef fish keep algal abundance low. Damselfish, however, ward off such grazing fish from their territories, creating areas of increased algal biomass. Focusing on the role of algal biomass on potential coral nursery habitats, Susie placed standardized terra-cotta coral settlement plates inside and outside of Damselfish territories.

After 27 months, baby coral densities were 73% higher in well-grazed treatments. This suggests that herbivory, or a lack thereof, explains a considerable portion of the variance associated with coral recruitment at a very local scale. Thus, careful management and monitoring of herbivores could improve the potential for coral reefs to recover from disturbances.

Susie is staying on at UMaine to pursue a Ph.D. in Marine Biology. Her dissertation research will focus on various aspects of coral recruitment from a more regional perspective, including larval choice experiments, juvenile survivorship rates and a manipulative demonstration of the importance of conserving particular species of grazing fish.

Curt Brown worked with Dr. Rick Wahle, Bigelow Laboratory for Ocean Sciences and Graduate Faculty in the School of Marine Sciences, studying predation pressure on juvenile lobsters from Rhode Island to Maine. He used video monitoring as well as diver and ROV surveys to determine abundance and diversity of lobster predators, and tethering experiments to determine relative predation rates. Curt's findings confirm that predation pressure increases from north to south, as does the diversity and abundance of predatory fish. The interesting twist to his story is that a recent episode of very high recruitment of crabs has made life more risky for newly settled lobsters in the Gulf of Maine.

For the Marine Policy portion of his degree, Curt looked at lobster fishery regulations which were largely initiated and enforced by lobstermen; exploring the history behind this unique conservation ethic and why it persists today.

Curt now works as a research technician at the Gulf of Maine Research Institute in Portland and as a lobsterman out of Cape Elizabeth. He is also involved in www.catchapieceofmaine.com, a business venture with a new means of marketing Maine lobsters and the lobstering tradition.



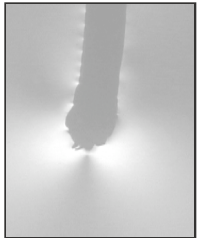
Curt Brown



Dr. Bernie Boudreau, Dr. Larry Mayer, Dr. Pete Jumars & Dr. Kelly Dorgan

Oceanography Ph.D. Awarded to Kelly Dorgan

Working with Dr. Pete Jumars, **Kelly Dorgan** studied the biomechanics of worm burrowing and discovered that a worm functions more like a wedge than a backhoe, using crack propagation rather than excavation, to tunnel through muddy sediments.



Gelatin is a suitable analog for mud, having many of the same mechanical properties. Like mud, it is a cohesive, elastic solid. Unlike mud, however, gelatin is translucent and birefringent. Using a video camera and polarized light Kelly was able to not only see crack propagation, but also quantify the stresses necessary for the sandworm, *Nereis virens*, to propagate cracks in the gelatin.

The implications of Kelly's findings may be far-reaching. In addition to "rewriting" textbooks on worm locomotion, her findings may also hold for other mud-inhabiting marine fauna including clams, small crustaceans and anemones, and may impact bioturbation models.

Kelly is now a postdoctoral fellow with Dr. Mimi Koehl at the University of California, Berkeley. With funding from the National Science Foundation, she plans to study the energetic (metabolic) cost of burrowing and the flux of materials through sediments due to burrowing/mixing.

GRADUATE STUDENT POSITION AVAILABLE

Pete Jumars and Lee Karp-Boss of the School of Marine Sciences recently received a four-year, \$521,423 grant from the National Science Foundation for fundamental studies of the effects of turbulence on the base of the marine food web and are looking for a graduate student to help, beginning in June 2008. Their work is collaborative with Lisa Fauci, a mathematician at Tulane University, who received an additional \$471,430 to carry out a complementary numerical modeling component. Led by the UMaine team, this effort aims to understand mechanisms by which turbulent stirring stimulates primary production. Dr. Fauci will first run very detailed and accurate numerical models to predict interactions of phytoplankton with turbulent vortices. The UMaine team will then test these predictions with real phytoplankton in laboratory devices constructed specifically to simulate selected aspects of turbulent vortices. The work is fundamental to understanding how climatic warming, which is expected to decrease turbulent stirring globally through increased ocean stratification but to increase it locally through modified weather events, will affect production in marine food webs.

Teaching Tools

As the National Science Foundation and other funding agencies promote the dissemination of cutting-edge science in K-12 classrooms the number of opportunities for teachers to interact with research scientists increases. In addition, scientists have begun to team up with education professionals to develop lesson plans and materials for classroom use.

UMaine researchers and educators have responded rapidly to this call. In 2007, two great workshops for secondary school teachers were offered at the DMC: **Aquatic Invaders in Maine (AIM): Education, Exploration and Stewardship** and **Teaching Science by Ocean Inquiry**. Both programs were designed to help teachers bring current events, current technology and current teaching techniques into the classroom. In addition, UMaine/DMC researchers participating in the ECOHAB-PNW program have helped create a video, **Hunt for Killer Algae**, and educational material for teaching about phytoplankton and harmful algal blooms.



COSEE-OS hosted the second annual teachers workshop **Teaching Science by Ocean Inquiry** at the DMC this summer. The goals of the workshop were to introduce teachers to ocean and climate-related processes that can be used to teach general physical concepts such as density, buoyancy, pressure, heat, temperature and waves, and to develop a network between teachers, scientists and experts in education.



Teaching Science by Ocean Inquiry

The participating teachers hailed from secondary schools in Maine, New Hampshire, Massachusetts, Virginia, South Carolina and Georgia. Working with Dr. Lee Karp-Boss and Dr. Emmanuel Boss from the School of Marine Sciences and Dr. Herman Weller from the College of Education, teachers were engaged in a variety of hand-on activities and pedagogic discussions on inquiry-based learning and teaching. Teachers used workshop material to develop lesson plans and activities that will help their students learn physical science in the context of ocean-climate interactions.

This workshop will be offered again July 21-25, 2008. Details will be made available on the DMC and COSSE websites.



AIM participants scour the coast.



Aquatic Invaders in Maine (AIM) was a weeklong workshop for middle school teachers from Maine. Offered by Maine Sea Grant/Cooperative Extension, the program presented the emerging issue of aquatic invasive species as a means of teaching aquatic biology and biodiversity and to promote environmental awareness and stewardship.

Working directly with State of Maine and University scientists, teachers reviewed ecosystem concepts (species identification, classification, adaptation) and improved scientific skills (observation, identification, experimental design). Teachers were also introduced to Noteshare, a software application that allows students and teachers to compile and share data on their Apple laptops. Apple computer specialists and Noteshare software designers provided technology training.

Esperanza Stancioff, AIM coordinator, reports that most of the participating teachers incorporated invasive monitoring programs into their biology curriculum this fall. As a result, students across Maine have been actively surveying and monitoring invasive species in lakes, wetlands and intertidal zones.



Dr. Mark Wells, graduate student Lisa Pickell and research specialist Kathy Hardy have been an integral part of the Ecology and Oceanography of Harmful Algal Blooms in the Pacific Northwest (ECO HAB-PNW) program for the past 5 years.



Kathy Hardy on deck with the film crew of "Hunt for Killer Algae"

Last fall, on the last research cruise of the project, a film crew accompanied the scientists aboard the R/V *Thomas G. Thompson*. The film crew captured the scientists at work and interviewed them about the science and their careers. The result is a 20-minute video **Hunt for Killer Algae** highlighting oceanographic research and harmful algal blooms.

The video and classroom activities for junior high and high school students can be downloaded for free at www.nwfsc.noaa.gov/hab/outreach/education.html.

More information about the research is at www.ecohabpnw.org.



DBTW 2007



Dev Bio Marks 15 Years

The **Developmental Biology Teaching Workshop** has been offered annually at the Darling Marine Center for fifteen

years. The workshop was created by Dr. Leland Johnson of Augustana College, SD in 1992 to help undergraduate faculty lead successful developmental biology laboratory experiments. The course is now team-taught by Leland and Dr. Eric Cole from St. Olaf's College, MN. Eric is a Developmental Biology Teaching Workshop alumnus and has returned for the past eight years to lend his microscopy expertise.

The last two years have seen an expanded curricula which comprises four full days of instruction. Using *Drosophila*, chick embryos, *Spirostomum*, *Hydra*, planaria, *Lumbriculus*, sea urchins, sand dollar and flowering plants, Leland and Eric emphasize both classical microsurgical techniques as well as fluorescence microscopy and reporter gene technology. In addition, they offer tips and tricks for setting-up and maintaining a teaching laboratory, keeping specimens alive and trouble shooting classroom experiments gone awry.

Since its inception, the course has drawn over 135 undergraduate faculty representing small private colleges and large universities from across the United States and internationally from Canada, Turkey and Austria. In 2008, Dev Bio will be offered June 17-20. Registration information is available at www.dmc.maine.edu/courses.html.

2008 SUMMER COURSES



Shellfish Mariculture Techniques

May 19-23

A one-week course exploring the theory and practice of marine bivalve aquaculture in the Northeastern United States. SMS 309/598.

Instructor: Dr. Chris Davis

Developmental Biology Teaching Workshop

June 17-20

A four-day hands-on teaching workshop for college-level developmental biology teachers wishing to diversify their laboratory lessons. Instructors: Dr. Leland Johnson & Dr. Eric Cole

Teaching Science by Ocean Inquiry

July 21-25

A five-day workshop in which high school physics teachers will team up with research scientists to promote ocean education and enhance science literacy.

Instructors: Dr. Lee Karp Boss, Dr. Emmanuel Boss & Dr. Herman Weller



WWW.DMC.MAINE.EDU/COURSES.HTML

2007 Visiting Graduate Student Awardees

For the past three years the DMC has supported graduate-level research through its Visiting Graduate Student Awards. These awards provide ready access to diverse marine habitats, flowing seawater laboratories and research vessels that graduate students find a boon to their research projects. Working at the DMC also provides visiting graduate students the opportunity to interact with resident researchers, faculty and students, thereby broadening their network and their horizons.

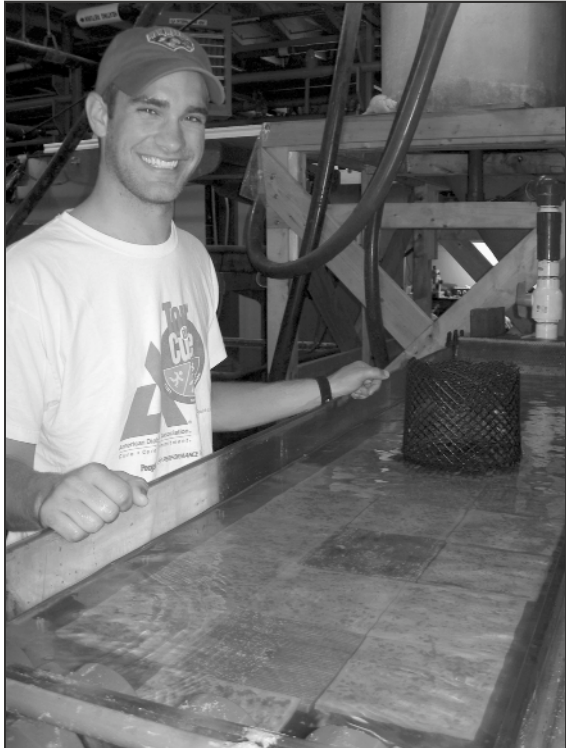
This summer the DMC was proud to host visiting graduate students from across the US and Canada working on invasive species, marine mammals, intertidal community structure and copepods reproduction. Working at both the Masters and Ph.D. level, these graduate students represent the next generation of marine scientists. Their contributions to science, fishery management, outreach and education will be felt at many levels.

Dashiell Pappas is interested in the ecology, evolution and behavior of marine mammals. She is a graduate student at the University of New England working towards a master's degree in Marine Sciences with Dr. Kathryn Ono.

Grey seals are believed to compete with fishermen for commercially valuable species like cod and flounder, but the diet of these piscivorous animals has not been studied in the state of Maine. Dashiell's thesis research aims to gain insight into the diet of grey seals and delineate the extent to which grey seals compete with fisheries in Maine waters.

This project, however, required access to seal habitats. Dashiell used her award to charter the R/V *Ira C.* to get to remote islands in Penobscot Bay. Leaving the dock at 4:30 in the morning with Captain Robbie Downs and a couple of field assistants, the team would approach the haul out sites and collect feces. By sieving the scat and collecting otoliths (fish ear bones) Dashiell will be able to determine the species and size of fish ingested by seals. Dashiell is also using a new technique in the field of dietary studies, fecal DNA, to look for prey species that do not traditionally show up when looking for fish otoliths.

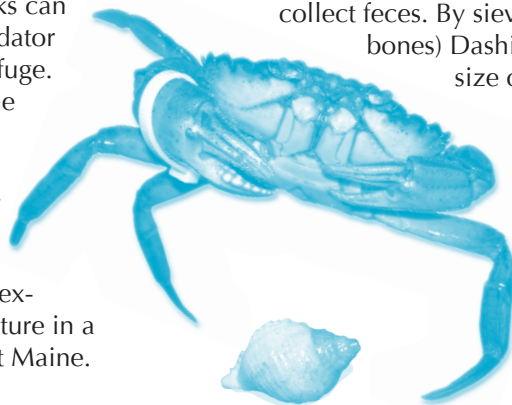
Dashiell hopes the resulting data will yield information useful to fisheries management models, as well as gray seal ecology, feeding and foraging habits.



Scott Large, DMC Visiting Graduate Student from Texas A&M University-Corpus Christi.

Scott Large is a master's student at Texas A&M University-Corpus Christi studying marine ecology. His research questions focus on how the physical conditions of the rocky intertidal habitat affect the behavior between predators (green crabs) and their prey (dogwhelks) and how this contributes to community structure.

In the Flowing Seawater Laboratory, Scott used the DMC flume to conduct a series of assays to determine how flow velocity, turbulence, predator species and diet affects the behavior of a common intertidal snail, the dogwhelk. Scott used acoustic Doppler velocimeters (ADV) to quantify the flow and turbulence in the DMC flume, as well as many sites along the Damariscotta River. In the lab he determined that as flow velocity increases dogwhelks can better detect a chemical cue from a predator resulting in more time spent within a refuge. However, in very high flow velocities the dogwhelks no longer respond to their predator. This information will be useful next field season when a larger, cooperative project between his advisor Dr. Lee Smee of TAMU-CC and Dr. Geoff Trussell of Northeastern University will explore how flow affects community structure in a large-scale field experiment in midcoast Maine.



Dashiell Pappas, DMC Visiting Graduate Student from the University of New England.

Rachel Lasley is a graduate student at Georgia Institute of Technology pursuing a Ph.D. degree in biology. In Dr. Jeannette Yen's landlocked Atlanta laboratory, Rachel has been studying how copepods use chemical signals to find females and mate. Working primarily with *Temora longicornus*, males of which are known to be able to detect, track and capture females, Rachel is trying to determine how these small crustaceans can differentiate the chemical trails of conspecifics and other copepod species.

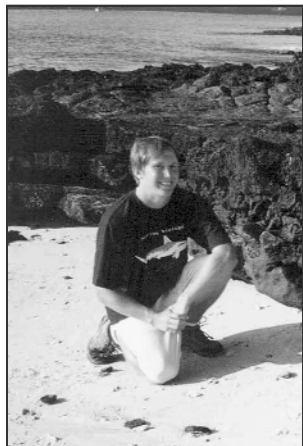
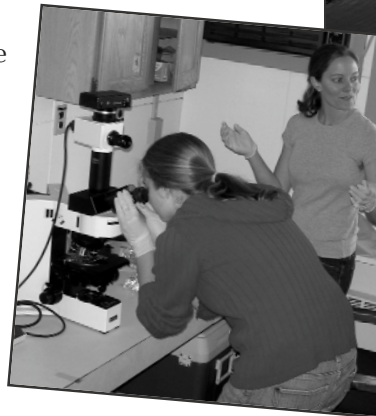
But lab experiments only go so far. Rachel needed to know more about the real world copepod populations: densities, sex ratios and relative species abundance, to determine if the chemical signals she was finding in the lab could be relevant in the ocean. Since *T. longicornus* is easily obtainable off the DMC dock, Rachel and the DMC were a perfect fit.

For four months, July through October, Rachel made daily collections of copepods to establish the relative species abundance of the local copepod population. To get a grasp on how successful males were at sniffing-out females, she stained the eggs of gravid females to determine fertilization rates and hence reproductive success.

While at the DMC, Rachel interacted with many students and faculty. She shared her egg staining technique with students in Dr. Jeff Runge's zooplankton ecology course.



Rachel Lasley, DMC Visiting Graduate Student from Georgia Institute of Technology.



David Delaney, DMC Visiting Graduate Student from McGill University, Canada.

David Delaney is a Ph.D. candidate at McGill University examining bioinvasions in marine ecosystems. Invasive species have been adapting to life in Maine waters for hundreds of years. Some invasives, like the European green crab,

arrived almost 200 years ago. Others like the Asian shore crab, are more recent arrivals to Maine waters and their unknown potential impact on marine systems is cause for concern.

David is using these two species to create an "invasion spread model" by coupling similar models used in terrestrial systems with some novel modeling techniques. To this end, David had collected historical, anecdotal and quantifiable data on the location and abundance of each species. He also established a network of a thousand volunteers, which monitor 60 sites in seven states for invasive species.

David used his time at the DMC to improve monitoring techniques and to fill in gaps in his own data sets and national ones, which will help forecast the potential speed and spatial extent of bioinvasions and give managers a time frame in which to implement strategies for control/eradication.

VISITING GRADUATE STUDENT AWARDS

\$ 3,400 ANNUALLY FOR 1-4 YEARS

The DMC helps graduate students conduct marine biology and oceanography research at our world-class marine laboratory by offering in kind awards that make field research logistically and financially possible. The awards provide housing, lab space, microscope use, boat time and SCUBA support to qualified graduate students.

The DMC has increased the value of these awards in 2008 and is now granting up to \$3,400 annually for 1-4 years, allowing graduate students to plan long-term projects. Eligible students must be currently enrolled in a graduate program and preference is given to students who have had limited marine lab or field station experience and whose thesis research is field-oriented.

Application information is available at www.dmc.maine.edu/gradawards.html. Application deadline is February 15, 2008.



9th International Polychaete Conference

The DMC hosted the 9th IPC in Portland, Maine this summer. In attendance were almost 200 researchers from across the USA and representing 32 foreign countries. The program included four days of scientific presentations, several social events and a polychaete sampling trip to the DMC.



Visiting Investigator Spotlight

For the past 15 summers, Dr. Rick Wahle of the Bigelow Laboratory for Ocean Sciences has used the DMC as a base of operation for his underwater research on lobster ecology. This year Rick and his team worked side-by-side with lobstermen on two projects geared toward augmenting our understanding of the lobster fishery in New England.

The first project is based downeast in Stonington where Maine's Zone C Lobster Hatchery has been raising juvenile lobsters with the intent of "seeding" nearby fishing grounds. The trick is to find a perfect age for release—the age at which survival and retention are greatest. When the hatchery released 14-day-old Stage IV lobsters, the divers were unable to find the crustaceans just days after release. However, when 28-day-old Stage V lobsters were released, the dive team had better luck, finding lobsters of appropriate age on each sampling trip since the release. To confirm they are from hatchery stock, these specimens will be sent off for genetic fingerprinting analysis. Sampling will continue in the coming years to see if this and future cohorts become established in the area. This project has been made possible by the Penobscot East Resource Center, www.penobscotest.org.



Members of the 2007 Wahle lab (left to right): Dan Shea, Charlene Bergerone, Katie Kershaw, Dr. Rick Wahle and Brad Kiehl.



Above left: Rich Crowley, Zone C Lobster Hatchery, preparing a passive postlarval collector for deployment. Above right: Katie Kershaw sorts samples.

The second project, supported by NOAA's Northeast Consortium, aims to provide settlement data that will improve lobster production models used by fishery managers. Currently, managers rely on SCUBA divers to conduct annual underwater surveys to quantify lobster settlement. Since most of the Gulf of Maine is too deep or too dangerous for divers, the models may significantly underestimate lobster production in the Gulf.

To survey these waters, Rick developed a "passive post larval settlement trap." The traps are 200 pound wire-mesh boxes of cobble, the preferred settlement substrate of juvenile lobsters, that can be set on the sea floor and hauled-up by lobster boats. With the help of fishermen, Rick's team constructed and set 300 settlement traps in the Gulf of Maine, from Rhode Island to Maine. Preliminary results have already expanded the depth of recorded lobster settlement from less than 25m to more than 80m.

VISITING INVESTIGATORS

The DMC is a user-friendly field station for marine researchers. Competitive rates and easy access to diverse intertidal habitats and the Gulf of Maine have drawn hundreds of scientists to the DMC in the last decade. Our professional support staff can provide assistance with specimen collection, equipment use, laboratory set up and housing. For more information, contact Tim Miller, Laboratory Manager, at temiller@maine.edu.

VISITING SCHOLARS

The DMC invites senior-level faculty and researchers to work in residence during the academic year, September to May. Selected Scholars will receive free furnished housing and office space. Preference will be given to applicants who will collaborate or interact with resident faculty and students in a way that will be mutually beneficial. Interested applicants should submit a letter of interest to Dr. Kevin Eckelbarger, DMC Director, at kevine@maine.edu



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◆ PLANS FOR 2008 ◆

The DMC will be at the **2008 SICB Meeting** in San Antonio, TX. Swing by our booth to learn more about our great programs.

Summer course offerings and registration materials are posted at www.dmc.maine.edu/courses.html.

Semester by the Sea applications available at www.dmc.maine.edu/sbs.html and due March 21.

Applications for **Visiting Graduate Student Awards & Visiting Scholar** positions are currently being accepted.

NOTE: Visiting Graduate Student Awards have increased. Funding is now available for 1-4 years. Read more on page 9.



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