Making Waves
At the University of Maine's Darling Marine Center
THE UNIVERSITY OF MAINE 1865

Semester by the Sea

Where professors become mentors, opening eyes and doors to marine research.

What do you get when you give undergraduate students and faculty a classroom, a research vessel, a flowing seawater laboratory, and a wide selection of marine habitats? A unique learning experience for marine science majors called Semester by the Sea (SBS).

The University of Maine's School of Marine Sciences' SBS program offers juniors and seniors from UMaine and other academic institutions a chance to explore the disciplines of marine science in a high tech and high expectation environment. This semester, the DMC hosts the largest SBS class yet, a true sign that the program's goal of getting undergrads out of the classroom and into the field is being achieved.

SBS students do more than just sit in class and take notes. Experimental design, field work, data analysis and report writing are emphasized in the marine ecology course, while discussion and debate are at the heart of the marine conservation biology course. Invertebrate zoology students scour the intertidal with shovels, sieves and buckets, and sample the depths with grabs and tows in an attempt to collect and identify 100 species of marine animals. In the flowing seawater lab they use a flume to learn about form and function and life in moving fluids. The emphasis is not on individual classes, but on tying it all together.

Top: Marine Ecology Class aboard the R/V Ira C. Above left: Using the flume to learn about fluid dynamics in the Design of Marine Organisms class. Above right: Students in the Invertebrate Zoology class with sediments from a Smith-Mac grab.

Opportunities also exist for laboratory experiences. Some SBSers fulfill independent research requirements while others do work-study programs. This semester, George Sharrard is working in Dr. Larry Mayer's biogeochemistry lab analyzing sediment cores taken in the Gulf of Mexico and the Gulf of Maine. He applied for the job because it looked like "a really cool place to work." George is also hoping to go to graduate school and saw the lab experience as a way to test the waters and dabble in a possible field of study.

There's no doubt about it, SBSers have to study hard, but they also make friendships and have experiences that last a lifetime. Applications for SBS '05 are available at www.dmc.maine.edu.

For more information about the School of Marine Sciences' undergraduate program and SBS, contact: Dr. William Ellis at 207-581-4381 or wge@umit.maine.edu

Inside this Issue

9th International Polychaete Conference

Hosted by the Darling Marine Center
Portland, Maine • August 12-18, 2007

Posters, presentations & post conference workshops are being planned. Stay tuned!

Info at www.dmc.maine.edu/worms.html

Maine Sea Grant

Oyster Gardening

Modeled after Cooperative Extension's Master Gardening Program, Oyster Gardening is a non-commercial, educational program that uses the process of growing oysters to engage participants in topics like estuarine ecology, shellfish biology, aquaculture regulation, stewardship, public health, and resource management.

Oyster gardening got its start in the Chesapeake Bay region, and has since spread to many other coastal states. Maine's Oyster Gardening program hit the ground running in March 2004 with 24 participants. Dr. Chris Davis of the Maine Aquaculture Training Institute (MATI) and the Pemaquid Oyster Company is the principal instructor, and Dana Morse, Maine Sea Grant Extension Associate based at the Darling Marine Center, is the program coordinator.

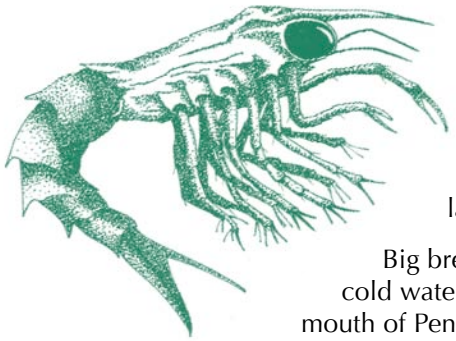
Throughout the spring, participants received classroom instruction on the basics of oyster culture and were assisted in securing the appropriate permits, licenses and leases from the Maine Department of Marine Resources. In July each received approximately 1000 Eastern Oyster seed, *Crassostrea virginica*, and "planted" them in floating trays on their individual or "community" lease sites. Each participant is responsible for maintaining his or her crop.

Chris, Dana and the oyster growers will continue to meet monthly for another year, to review progress, share observations, and listen to guest speakers. At that point, next fall, some of the oysters will be big enough to eat, but most will take close to two years to reach full size.

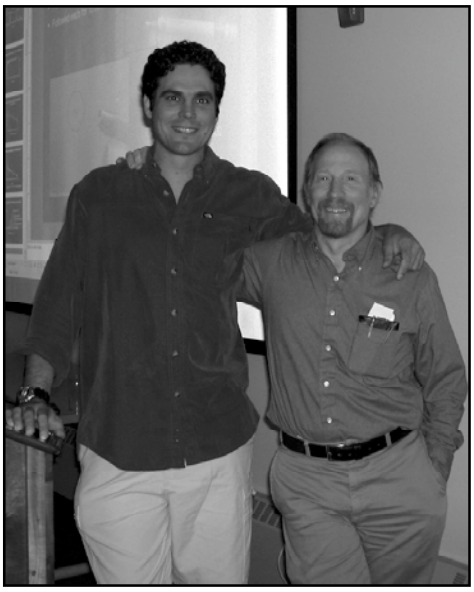
A second oyster gardening workshop is tentatively scheduled for 2006. For more information on this program, contact Dana Morse at dana.morse@maine.edu or visit the Maine Sea Grant

Degree Awarded

Dr. Eric Annis



Eric Annis successfully completed his Ph.D. with the defense of his thesis "Biology and ecology of lobster larvae (*Homarus americanus*) and implications for population connectivity and larval transport" in May.



Dr. Eric Annis and his advisor, Dr. Bob Steneck

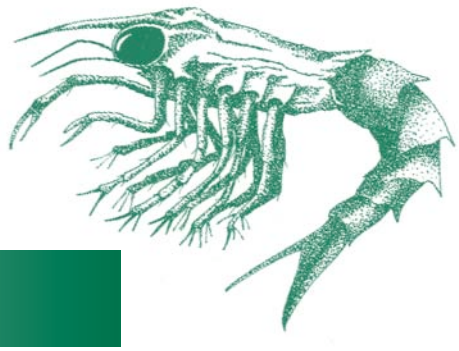
Big breeding lobsters are found in the deep cold waters off Grand Manan and the Eastern mouth of Penobscot Bay, while postlarvae were found mostly on the western mouth of Penobscot Bay. Eric wanted to know how the two populations were connected and what mechanism was responsible for this unique situation. It appears that prevailing currents, water temperature, and larval development time all play a role.

The Gulf of Maine's prevailing currents, notably the Eastern Maine Coastal Current, move westward along the coast transporting larvae from both breeding grounds Downeast to the settlement sites to the west. Having larvae delivered from multiple sources may contribute to the resilience of the fishery.

Lobster larvae prefer warm water. Eric seldom found larvae below the 12°C thermocline. Early in the larval season when the water is still cold, the postlarvae spend more time at the surface, but as the season progresses surface waters warm (and the depth at which 12°C occurs is deeper) and they spend less time at the surface. The important implication: if the postlarvae are actively avoiding temperatures below 12°C, the temperature on the bottom may play an important role in determining when, where, and how deep postlarvae settle.

Eric also estimated the development time of larvae in the field to be 1.5 to 3 times faster than the development time previously recorded in laboratory studies. Eric's revised estimates suggest that larvae are probably not carried as far as we had previously expected.

Eric is now a postdoc at the Institute of Marine and Coastal Sciences, Rutgers University, working with Dr. Rich Lutz.



Dissertation Defended

Aimee Phillippi

Earlier this fall, Aimee Phillippi defended her thesis dissertation "A comparative study of self-fertilization in the life histories of three ascidian species with contrasting dispersal patterns" and is in now in the final throws of revisions.

Most marine invertebrates reproduce by methods of cross fertilization, where eggs are fertilized with sperm from different individuals, but some have the ability to self-fertilize. Population geneticists believe self fertilization can lead to inbreeding and have detrimental effects on the population.

But if it is all bad, then why do some organisms do it? Aimee believes self-fertilization is a beneficial reproductive strategy for some marine invertebrates, particularly sessile organisms with limited ability for gamete/larval dispersal.

Working with Dr. Phil Yund, Aimee conducted a comparative study of the reproductive biology of three ascidians (tunicates or sea squirts) that live in the Damariscotta River. The intent of her study was to test the hypothesis that limited dispersal species are more likely to incorporate self-fertilization as part of their reproductive strategy than are broad dispersal species. Her project required extensive lab and field studies of the organisms including numerous fertilization experiments as well as the use of molecular biology techniques.

Aimee's results show that there is a time and place for everything, and that in certain life history strategies, self-fertilization can be advantageous.

Graduate Research

Kelly Dorgan, a Ph.D. candidate working with Dr. Pete Jumars, found that worms use crack propagation rather than excavation to burrow though muddy sediments.

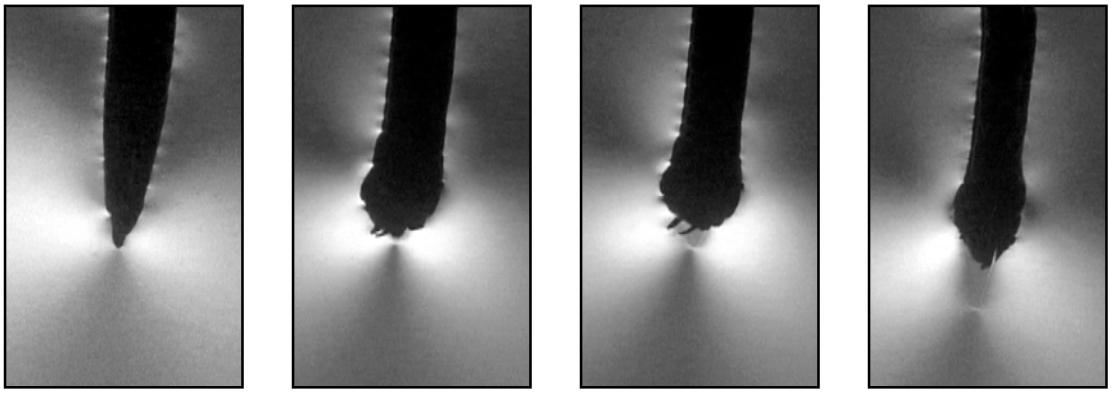
Biomechanically, it was thought that worms burrowby pushing sediments aside, essentially excavating their burrows. This means of locomotion is energetically expensive compared to flying, swimming or running. If this is true, how could a deposit feeder such as the common sand worm, *Nereis virens*, get enough calories and nutrients from its diet of mud to do all this excavating?

To find out, Kelly decided to watch worms borrow. First, she had to find a substance that behaved like mud, but that was clear enough to see through. The answer, she found in scientific literature, was gelatin. As it turns out, muddy marine sediments behave more like a cohesive elastic solid than like an accumulation of individual sediment grains.

Kelly filled a 5-gallon aquarium with double-strength gelatin made with seawater. She set the tank on a photographic light table rigged with polarizing filters, initiated a crack, added a worm, and video taped the process. Kelly determined that *Nereis* does indeed burrow by crack propagation, not by excavation.

The polarizing filters not only made the burrow and worm clearly visible, but also allowed Kelly to quantify her results. As can be seen in the photographs below, the force exerted on the gelatin by the worm shows up as a light-colored halo around the burrow. Using known weights she determined the amount of pressure needed to recreate the stress fields and, hence, to crack gelatin.

Locomotion via crack propagation requires an order of magnitude less energy than does excavation. Hence animals that burrow by this method have energy requirements in line with swimmers, flyers and runners. Kelly believes that the shape of an organism may give a clue as to is mode of locomotion noting that other mud inhabiting critters such as clams and echiniods are also wedge-shaped.



These photographs show Nereis *burrowing through gelatin by crack propagation. Under polarized light, the force exerted on the gelatin by the worm shows up as a light-colored halo around the burrow.*

Recent Publications

Devin, M.G., R.J. Peacock & H.D. Stence. 2004. Development of grow-out techniques for juvenile sea urchins *Strongylocentrotus droebachiensis*. In Proceedings of the International Conference on Sea Urchin Fisheries and Aquaculture 2003. J. Lawrence, Ed., DEStech Publications, Inc. Pp. 246-254.

Giessing, A.M.B. & **L.M. Mayer**. 2004. Oxidative coupling during gut passage in marine deposit-feeding invertebrates. Limnol. Oceanogr. 49:716-726.

Gonzalez, E. & **L. Watling** 2003. A new species of *Hyalella* from the Patagonia, Chile, with the redescription of *H. simplex* Schellenberg, 1943 (Crustacea: Amphipoda). J. Nat. Hist. 37(17):2077-2094.

Gonzalez, E. & **L. Watling**. 2003. A new species of *Hyalella* from Colombia and the redescription of *H. meinerti* Stebbing 1899 from Venezuela (Crustacea: Amphipoda). J. Nat. Hist. 37(17):2095-2111.

Gonzalez, E. & **L. Watling**. 2003. Two new species of *Hyalella* from Lake Titicaca and redescriptions of four others in the genus

Grabowski, J.H.. 2004. Habitat complexity disrupts predator-prey interactions yet preserves the trophic cascade in oyster-reef communities. Ecology 85:995-1004.

Grabowski, J.H. & S. P. Powers. 2004. Habitat complexity mitigates trophic transfer on oyster reefs. Mar. Ecol. Prog. Ser. 277:291-295.

Grabowski, J.H S.P. Powers, & M. Hooper. 2003. Identification and incorporation of growth and survival bottlenecks in economic models of northern quahog (hard clam), *Mercenaria mercenaria*, mariculture. J. Shellfish Res. 22:697-703.

Guieb, R.A., **P.A. Jumars** & R.F.L. Self. 2004. Adhesive-based selection by a tentacle-feeding polychaete for particle size, shape and bacterial coating in silt and sand. J. Mar. Res. 62:261-282.

Haye, P., I. Kornfield & **L. Watling**. 2004. Molecular insights into cumacean family relationships (Crustacea, Cumacea). Mol. Phylogenet. Evol. 30:798-804.

Johnson, S.L. & **P.O. Yund**. 2004. Remarkable longevity of dilute sperm in a free-spawning colonial ascidian. Biol. Bull. 206:144-151.

Koehl,M.A.R., **P.A. Jumars** & L. Karp-Boss. 2003. Algal biophysics. pp. 115-130 in T.A. Norton, Ed. Out of the Past. British

Graduate Research

Working with Dr. Les Watling, graduate student Emily Knight is studying the effects of trawling on mixed-bottom habitats. Her project is unique in that it was proposed by a fisherman, Cameron McLellan, and requires the knowledge and cooperation of both fishermen and scientists.

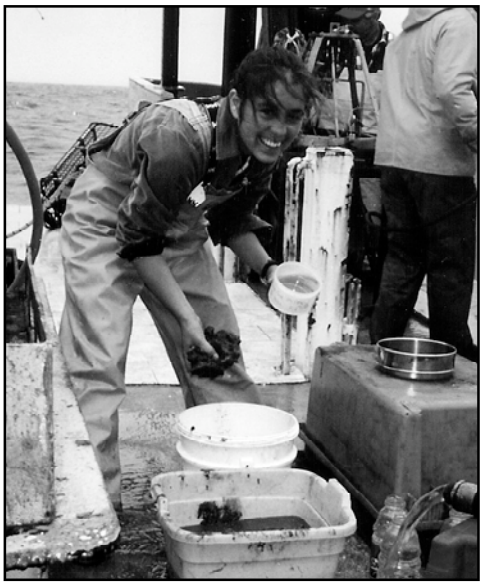
The sediments of mixed-bottom habitats are characterized as till, a mixture of sand and gravel size particles. Sponges, tunicates, hydroids, sea stars, anemones, polychaetes, crustaceans and bivalves are typically found in and on these sediments. In the water column above these sediments, pollock, cod and haddock make their home. Consequently, mixed-bottom habitats in the Gulf of Maine have seen heavy fishing pressure over the years. The question is, how harmful is trawling to the animals in mixed-bottom habitat and to what extent can the communities rebound after being disturbed by fishing gear.

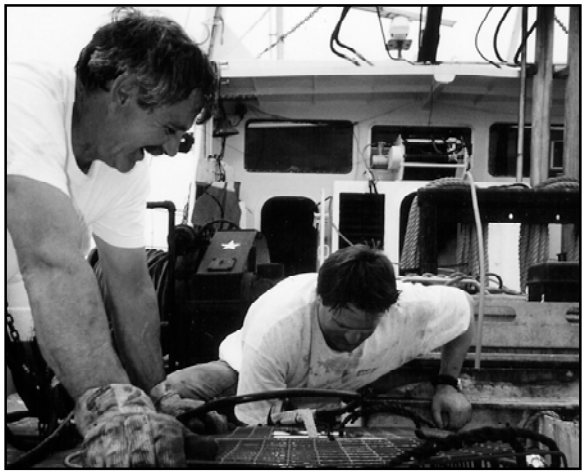
Based in Portland, Cameron McLellan fishes for cod, pollock, haddock and flounder aboard his 72' trawler, the F/V Adventurer. Concerned about ever restrictive fishing regulations, Cameron wanted to see for himself how habitat impacts are measured and how management decisions are made. He sought out Les, one of the most outspoken defenders of the sea floor, and offered his fishing boat to research.

Les and Cameron secured funding from the Northeast Consortium and the National Marine Fisheries Service, and Emily got to work. Spending about 70 days at sea over the past two years, Emily, Cameron and Chief Mate Arthur Mortin collected data from recently trawled sites on popular fishing grounds in the Gulf of Maine, and "recently undisturbed" sites within the Western Gulf of Maine Closed Area and Stellwagon Banks National Marine Sanctuary.

They recorded hours of underwater video using a remotely operated vehicle (ROV), and sampled the seafloor with a Smith-Mac sediment grab. Emily is now sorting the samples, and viewing the videos, recording each species and their abundance.

No matter what the final results are, the biggest hope Cameron and Emily have is that their project will serve as an example of how fishermen and scientists can cooperate on the most sensitive of issues.





Top: Emily Knight sorting samples aboard the F/V Adventurer. Above: Chief Mate Arthur Mortin Captain Cameron McLellan prepare the ROV.

Lenihan, H.S., C.H. Peterson, S.L. Kim, K.E. Conlan, R. Fairey, C. McDonald, **J.H. Grabowski** & J.S. Oliver. 2003. Variation in marine benthic community composition allows discrimination of multiple stressors. Mar. Ecol. Prog. Ser. 261:63-73.

Mayer L., **L. Schick**, **K. Hardy**, **R. Wagai** & J. McCarthy. 2004. Organic matter content of small mesopores in sediments and soils. Geochimica et Cosmochimica Acta 68:3863-3872.

Parker, M.S., **P.A. Jumars** & L.L. LeClair. 2004. Population genetics of two bivalve species (*Protothaca staminea* and *Macoma balthica*) in Puget Sound, WA. J. Shellfish Res. 22:681-688.

Peterson, C.H., **J.H. Grabowski**, & S.P. Powers. 2003. Estimated enhancement of fish production resulting from restoring oyster reef habitat: quantitative valuation. Mar. Ecol. Prog. Ser. 264:249-264.

Powers, S.P., **J.H. Grabowski**, C.H. Peterson, & W.J. Lindberg. 2003. Estimation of expectation and uncertainty of augmented fish production per unit area of artificial reef. Mar. Ecol. Prog. Ser. 264:265-277.

Steneck, R.S., & J.C. Lang. 2003 Rapid assessment of Mexico's Yucatan Reef in 1997 and 1999: pre- and post- mass bleaching and Hurricane Mitch (story, corals, algae and fish). Pp 304-317 in J.C. Lang (ed.), Status of Coral Reefs in the western Atlantic: Results of initial Surveys, Atlantic and Gulf Rapid Assessment (AGRRA) Program. Atoll Research Bull. 496.

Steneck, R.S., J. Vavrinec & A.V. Leland. 2004 Accelerating trophic level dysfunction in kelp forest ecosystems of the western North Atlantic. Ecosystems 7(4):323-331

Thiel, M., E.R. González, M.J. Balanda, Pilar Haye, R. Heard & **L. Watling**. 2003. Diversity of Chilean Peracarids (Crustacea: Malacostraca). In M.E. Hendrickx (ed.). Contributions to the Study of East Pacific Crustaceans, Volume 2:177-189.

Voparil, I.M. & **L.M. Mayer**. 2004. Commercially-available chemicals that mimic a deposit-feeder's (*Arenicola marina*) digestive solubilization of lipids, Environ. Sci. Tech. 38:4334-4339.

Weston, D.P., J.R. Judd, & **L.M. Mayer**. 2004. The effect of extraction conditions on trace metal solubilization in deposit feeder digestive fluid. Environ. Tox. Chem. 23:1834-1841.

For our Visitors

DMC Announces New Visitor Programs

Visiting Scholars Program

Senior-level faculty and researchers are invited to work in residence at the DMC any time during the academic year (September-May). Located in one of the most scenic areas of New England, the DMC is the perfect venue to write papers or books, to conduct field work, or to explore new research directions. We offer a stimulating intellectual atmosphere, a first-rate marine library, flowing seawater laboratories, and state-of-the-art scientific instrumentation.

Selected Scholars will receive free furnished housing and office space. Reasonable requests for laboratory space will also be accommodated. Scholars with families are welcome. Preference will be given to applicants who will collaborate or interact with resident faculty and students in a way that will be mutually beneficial. Individuals who would like to teach a graduate level course or an undergraduate course in the Semester-by the Sea program are encouraged to explore this option with the Director although this is not a requirement of the program.

Interested applicants should submit a letter to DMC Director, Dr. Kevin Eckelbarger, outlining their proposed activities while in residence. Application letters will be accepted at any time.

Visiting Graduate Student Fellowships in Marine Biology and Oceanography

First or second year graduate students looking to collect samples or conduct experiments at a world class marine laboratory will be happy to hear about the DMC's new Graduate Fellowships. Two fellowships will be awarded annually, one for marine biology students and one for oceanography students. Each offers $3400 of goods and services including: housing and lab space for up to three months, travel, supplies, boat rental, or other support required to conduct the project. Eligible students must be currently enrolled in a recognized graduate program. Preference will be given to students who have had limited marine lab or field station experience and who wish to conduct field-oriented studies.

To apply, graduate students must submit:

1) a letter of recommendation from thesis advisor
2) a 2-page research proposal outlining the project
3) a 1-page budget detailing anticipated expenses.

Application materials should be mailed to:

Visiting Graduate Fellowship Program
Darling Marine Center
193 Clark's Cove Rd.
Walpole, ME 04573

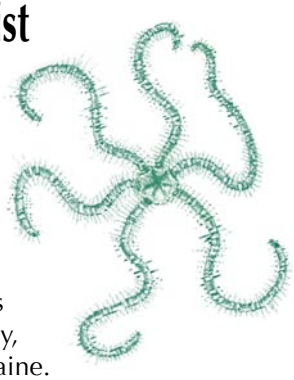
Applications will be reviewed by a committee of resident faculty. The deadline for applications is February 15, 2005. Selected students will be notified by March 15, 2005.

After an early October dive at the Rachel Carson Salt Pond, chilly DMC divers enjoy a BBQ and campfire.

DMC Supports Recreational Diving

DMC personnel including resident staff, students, interns and visiting scientists interested in recreational diving now have a forum to socialize and participate in diving related activities, both in and out of the water. In an effort to encourage safe recreational diving and underwater exploration, Diving Safety Officer, Chris Rigaud, worked to establish the DMC Scuba Club. Membership is open to UMaine/DMC personnel with recreational diving certificates and DMC safety training. The club makes DMC scuba support facilities and equipment such as tanks and air fills available to members.

Invertebrate Species List Added to Website



This winter a comprehensive species list will be added to the DMC website. It will include marine invertebrates commonly found in the muddy, sandy and rocky intertidal zones of the Damariscotta River estuary, and the waters of the Gulf of Maine.

The invertebrate species list will include taxonomic information, collection location, and habitat description (depth, substrate, etc.) We hope it will be useful information to perspective visitors.

In the near future we also plan to add a marine phytoplankton and macroalgae species list to our website.

Undergraduate Research

2004: Our 5th Year of Particpation in the NSF REU Program

With upwards of 30 students, the DMC's summer undergraduate internship program is among the largest of east coast marine labs. At the heart of the DMC internship program is the National Science Foundation's Research Experiences for Undergraduates (REU) program. However, other internship opportunities are provided though the Gulf of Maine Foundation, private donations, and individual faculty research grants. Here is a sampling of the undergraduate research accomplished at the DMC this summer:

Carrie Atkins, Bowdoin College
Reconstructing the Ronson Ship: the use of a research model. Advisor: Dr. Warren Riess

Meghan Barringer, Colby College
Crack propagation as a new mode of locomotion by burrowing Orbiniids. Advisor: Dr. Pete Jumars

Avery Briggs, Williams College
Emergence patterns of benthic copepods in the Damariscotta Estuary. Advisor: Dr. Pete Jumars

Jessica Bryant, University of California, Santa Cruz
Differential expression of carbon monoxide dehydrogenase genes in carboxydotrophic bacteria. Advisor: Dr. Gary King

Meredith Doellman, University of Notre Dame
Density dependent historecognition in the colonial ascidian, *Botryllus schlosseri*.
Advisor: Dr. Phil Yund

Heidi Fournier, Roger Williams University
Reproductive biology of the commensal deep-sea polychaete *Gorgoniapolynoe caeciliae* (Polynoidae). Advisors: Dr. Les Wating and Dr. Kevin Eckelbarger

Elisa Klingler, University of Maine
Effects of diatom morphology on direction and orientation in steady shear flow.
Advisors: Dr. Pete Jumars and Dr. Lee Karp-Boss

Dan Pinho, University of Maine
Exploring the Benthic Communities in the Great Salt Bay. Advisor: Dr. Les Watling

Kristy Podelnyk, University of Maine
Carbon Monoxide oxidation and genetic analysis of rhizobium bacteria in symbiotic relationships with legume species.
Advisor: Dr. Gary King

Elizabeth Roberts, Hamilton College
Asian shore crabs on the Coast of Maine: Full scale invasion or simple tenancy?
Advisor: Dr. Bob Steneck

Matt Stevenson, Amherst College
Iron oxide bound organic carbon losses in the Bird Foot Delta, Louisiana. Advisor: Dr. Larry Mayer

Catherine Whitaker, Duke Univ. & Shayle Reed, UNH
33 feet under the sea: the story of *Chondrus crispus*.
Advisor: Dr. Bob Steneck

Beth Whitehill, Illinois Wesleyan University
Function of the brood cup of the colonial ascidian *Botryllus schlosseri*. Advisor: Dr. Kevin Eckelbarger

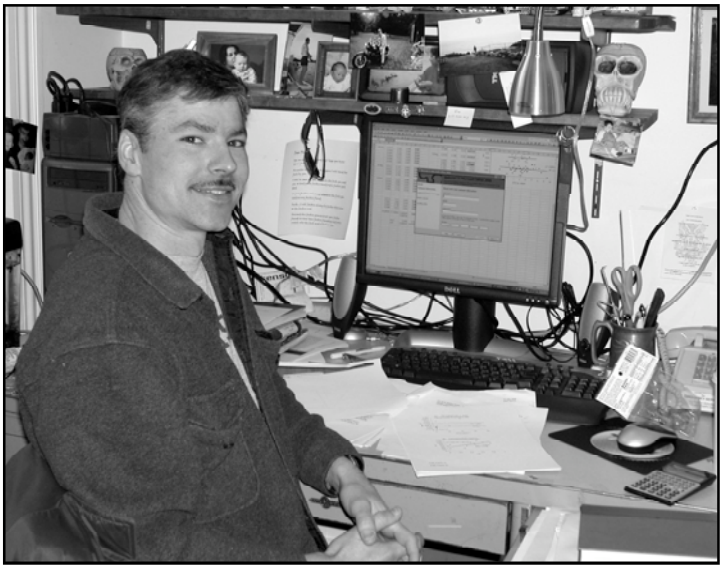
Full abstracts on line at www.dmc.maine.edu

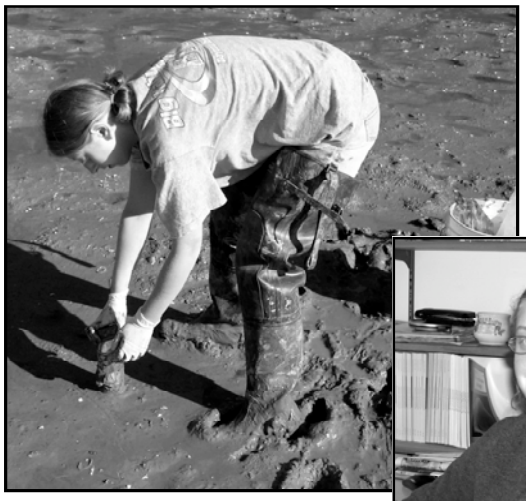
The NSF REU program at the Darling Marine Center honestly provided me with the best and most memorable summer of my life. My advisor was really concerned with the progress of my project and my own progress as a potential scientist, and he was always available to answer questions if I had them. I learned so much that could be applied to many aspects of my life, not just to future research. The program also helped me to gain more insight into what I want to do when I go to graduate school.

Beth Whitehill, Illinois Wesleyan University

Microbial Ecology Laboratory

Dr. Gary King's microbial ecology lab is analyzing communities of microorganisms living in water and sediments of the Damariscotta River and the Gulf of Maine. The goal is to understand the roles that these organisms play in chemical cycles involving carbon monoxide, hydrogen, ammonium and thiosulfate. The research will take advantage of analytical methods that King developed for microbial analysis and will apply for the first time in a marine system.





Dr. John Tolli joined Dr. Gary King's microbial ecology laboratory earlier this year as a postdoctoral fellow. John attended the MIT/WHOI Joint Program in Oceanography and studied under Dr. Craig Taylor in the Department of Biological Oceanography. His thesis research focused on the identity and phylogenetic relatedness of carbon monoxide oxidizing bacteria in seawater and their respective contributions to overall CO consumption.

Here at the DMC, John will be diving deeper into the realm of gene sequencing and using other molecular techniques to study the ecological role of terrestrial and marine bacteria which rely on CO and CO_2 .

On one hand he will be looking at the genetic diversity of the RubisCO enzyme in terrestrial and marine bacteria. This enzyme is of paramount importance in photosynthesis; all photosynthetic organisms possess it. Interestingly, non-photosynthesizing, autotrophic bacteria also have this enzyme which enables them to assimilate CO_2 into organic matter.

On the other hand, John will be looking at the genetic diversity of the CODH enzyme which allows certain bacteria to oxidize naturally occurring carbon monoxide to CO_2 and benefit energetically from the reaction.

For both studies, John will be collecting samples from the water and sediments of the Damariscotta River and the Gulf of Maine, and extracting DNA from various soil types. The end result will be a qualitative and quantitative study of autotrophic bacterial community structure in these habitats. He is hoping to identify various phylogenetic groups of bacteria with the RubisCO or CODH genes and quantify their respective roles in the microbial carbon cycle.

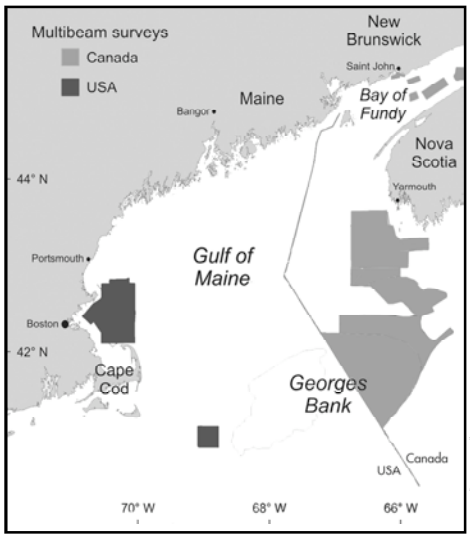
Lisa Nigro joined the King lab in August. She completed her B.S. degree at Rutgers University and is excited to combine her interests in microbiology, marine biology and phylogentics in a M.S. degree.

The focus of her research will be the lithotrophic bacteria present in Lowes Cove, an intertidal mudflat adjacent to the DMC. Specifically, she will be looking at the microbial community structure and diversity in four microenvironments: sulfur mats, burow walls of *Mya arenaria*, surface sediments (upper 2mm) and anaerobic sediments (5-7cm deep.)

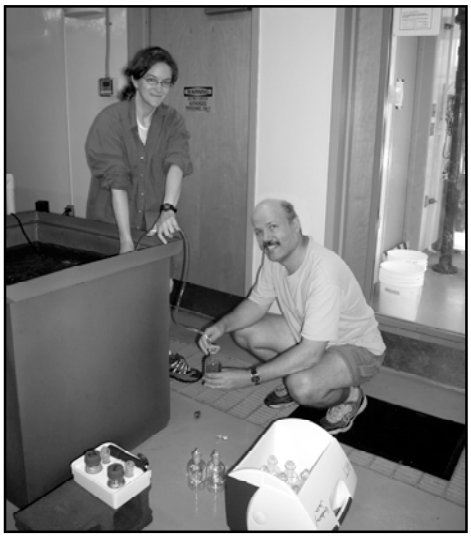
Lithotrophs are microorganisms that can use inorganic substrate as an energy source. Lithotophs are further divided into facultative and the obligate groups. Obligate lithotrophs are known to oxidize ammonium, nitrite, sulfide, sulfur and metals, while facultative lithotrophs are able to oxidize aerobic hydrogen and carbon monoxide.

Like John Tolli, she will be teasing apart the community structure of microbes using molecular techniques. By identifying the rbcL gene in her samples and constructing rbcL clone libraries, Lisa will be able to determine the microbial community structure and diversity of each microenvironment. She will also be able to determine phylogenetic relationships between and amongst the microbes.

UMaine Scientists at DMC



Credit: Gulf of Maine Mapping Initiative



Right: School of Marine Sciences' researchers Dr. Carol Janzen and Dr. Kjell Gundersen calibrate the sensors in the DMC Marine Culture Laboratory. Above: Dr. Kjell Gundersen collects field data.

GOMMI Conference

The Gulf of Maine Mapping Initiative (GOMMI) is a collaborative effort of government and non-government partners from Canada and the United States to produce high-resolution images of the Gulf of Maine's seafloor and to make these maps available to the general public.

Federal, state and local management agencies can use these maps to manage essential fish habitats and protected areas, to determine the placement of underwater fiber optic cables, pipelines, and dredging spoils, and many other resource management decisions.

Since 1994 roughly 15% of the Gulf of Maine has been mapped using state-of-the-art acoustic techniques. GOMMI wants to secure funding to map the remaining 85%. In October, fifty GOMMI collaborators including Dr. Les Watling and Dr. Joe Kelley, UMaine School of Marine Sciences, met at the DMC to hone their game plan and set priorities. With this in place, GOMMI hopes to secure the necessary funding and get the fieldwork underway.

To learn more about the GOMMI, the US/Canadian partnership, and seafloor mapping visit www.gulfofmaine.org/gommi

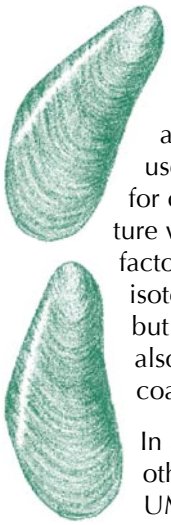
O_2 Sensors Field Tested

Physical, chemical and biological oceanographers rely on hi-tech sensors to record the ocean parameters. To ensure researchers have the most technologically advanced and the most reliable equipment NOAA has established the Alliance for Coastal Technologies (ACT).

Working with agency partners across the country, including the Gulf of Maine Ocean Observing System (GoMOOS), ACT provides unbiased third party tests of new technologies. Dr. Carol Janzen, Assistant Research Professor at the UMaine's School of Marine Sciences is the GoMOOS ACT Technical Coordinator. This summer she conducted in situ evaluations of dissolved oxygen sensors from four manufacturers at the DMC pier.

Dr. Carol Janzen and Research Associate Dr. Kjell Gundersen reviewed dissolved oxygen sensors from Aanderaa, In-Situ Inc., Greenspan Analytical, and YSI Environmental. The sensors were deployed for 29 days and were evaluated for accuracy, bias, precision, and reliability. Controlled laboratory and field test were conducted to evaluate the performance of the sensors under a variety of known and unknown environmental conditions.

The DMC experiments were successful with 100% data recovery from the sensors. A second round of test are currently being conducted at partner institutions. Final results will made available on the ACT website (www.act-US.info) in January 2005.



It's all in the Shells

Oxygen isotopes recorded in ancient bivalve shells have been used to reconstruct paleoclimates for over 50 years. Water temperature was believed to be the primary factor that determined the oxygen isotope composition in the shells, but new studies show that salinity also plays a roll, especially in coastal and ice marginal locations.

In an effort to recalibrate the paleothermometer, researchers from the UMaine's Climate Change Institute *edulis*, under controlled temperature, salinity/isotope regimes in the flowing seawater laboratories of the DMC. Back in Orono, the oxygen isotope ratio was determined, using a dual-inlet VG Micromass Prism mass spectrometer.

Preliminary results suggest that *M. edulis* records may be more suitable as a paleothermometer at lower temperatures (<10 ºC) than other calibrations.

Dr. Karl Kreutz, Dr. Harold Borns, Douglas "Cap" Introne, and graduate student Alan Wanamaker were involved

Gulf of Maine Foundation

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Graduate student Lisa Pickell helps 3rd graders at the Bristol School assemble a food web of critters they collected at the DMC.

Grads Make Great Role Models

Graduate student Leslie Taylor with a group of 3rd and 4th graders conducting an experiment with hermit crabs in our flowing seawater classroom.

Science, research, and role of inquiry become more immediate, alive and understandable to school children when the graduate students share their knowledge of marine life and ecosystems.

For the past few years, GMF Education Coordinator, Jan Faulkner, has recruited grad students to work in the GMF K-12 program. Amanda Leland, Heather Abello, Betsy Grannis, Leslie Taylor, Anne Simpson, and Lisa Pickell have all played a role. They help Jan develop curriculum and activities, lead field trips, and teach in the classroom. Jan also encourages spontaneous, informal interactions between grads and school kids, be it on the dock or in the flowing seawater lab. These are the moments when young students see "research" in action and they see adults engaged and interested in what they are doing.

It is this interaction between school children and grad students that makes the GMF K-12 program unique, be it on site at the DMC or back at the school. More than 1500 children from 12 midcoast schools have visited the DMC in 2004!

It is with deep sorrow we note the passing of

Dr. Kevin Eckelbarger and Mike Mitchell

David Michael Mitchell

Mike Mitchell twice served as President of the DMC's support group, the Gulf of Maine Foundation (GMF) and was a great friend of the Darling Marine Center. During his years as President and member of the GMF Board of Directors, Mike worked tirelessly to raise funds to help the Center purchase new research vessels, new classroom microscopes, and to establish a K-12 marine science program. As owner of a popular boat marina and the Coveside Restaurant, he often served as host to GMF meetings and special luncheons for the University President and Provost when they visited the DMC. He helped recruit distinguished speakers for the popular GMF Summer Lecture Series and he befriended many potential donors who would eventually assist the DMC. Mike was a world-class sailor who sailed his boat, Gunga Din, in local waters for many years. He often took visiting University administrators and dignitaries along to enjoy the Maine coastline while expounding on the Darling Center to all who would listen. Mike took his final sail on September 20, 2004.

The Gulf of Maine Foundation wants to thank all who have talked to school kids in the past year whether it was for 5 minutes or an hour.

Special thanks go to Emily and Dave Kallin, Kelly Dorgan, Curt Brown, Tom Langley, Hannah Waska, Shayle Reed, Thew Suskiewicz, Julien Gaudette, Emily Knight, Betsy Grannis, Eric Weissberger, Linda Schick, Larry Mayer, Sheri Johnson, Dana Morse, Scott Feindel, Robbie Downs, and Tim Miller who have added so much to our program.

38 Years and Counting

2006 will mark the 40th anniversary of the Darling Marine Center. Plans are underway for another reunion, but we need to update our contact list. We're looking to find as many faulty, staff, grads, interns and SBS'ers as possible. If you are still in contact with your DMC cohorts, spread the word! Better yet, send us their contact info and we'll tell them directly.

Please fill out the form to the right and mail it in, or send an e-mail to lisao@maine.edu with the same information. Thanks!

Library News

Construction and renovations are underway for the DMC library expansion—and not a moment too soon!

The current library is so crowded, 30% of its holdings are being stored in boxes, attics and other places around campus. The expanded library will accommodate all this and more when it is opened in the spring of 2005. When complete, the DMC library will house the largest collection of marine-related literature in the State of Maine.

With funding from the National Science Foundation's Field Stations & Marine Laboratories program, the DMC library will double in size. The floor plan will encompass about 3,900 square feet, and will include expanded space for books and bound journals, as well as a spacious current journal reading room and a conference room.


Louise Dean

With the new library quickly becoming a reality, we would like to once again ask you to make a donation to the Louise Dean Library Fund. Established in 2001 to provide resources for student computers, we now expand the fund's mission to include the purchase of couches, carousels and bookshelves.

Thanks for your support!

Alumni Update

Name: _____

Address: _____

_____

_____

Phone: _____

e-mail: _____

When did you work at DMC _____

Advisor/Position _____

Research topic _____

Current position _____

I have contact with undergraduates and would be willing to promote DMC programs internships, SBS, etc. ❑ Yes ❑ No

The Louise Dean Library Fund

Please return this form with your tax deductible donation to:

The Louise Dean Library Fund
Darling Marine Center
193 Clark's Cove Road
Walpole, ME 04573

Name: _____

Address: _____

_____

_____

Phone: _____

e-mail: _____

I would like to donate the following:

❑ $25 ❑ $50 ❑ $100 ❑ Other _____

Payment:

❑ Check payable to the Darling Marine Center
❑ Visa/MasterCard

_____

Expiration date _____

Signature _____

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Looking Ahead to Summer 2005

Courses and Workshops

CASE Media Fellowship:
New Waves in Marine Science
May 16-20. Print and broadcast journalists will learn how marine issues are being addressed in Maine. Topics include: remote sensing, deep sea biology, harmful algal blooms, lobster ecology, aquaculture, and beach management. Program begins in Orono and includes visits to the DMC and other marine research facilities.

SMS 309/598: Shellfish Mariculture Techniques
May 23-27. A one week course exploring the theory and practice of marine bivalve aquaculture as practiced in the Northeastern United States. Bivalve taxonomy, anatomy, reproductive biology and genetics; algal culture; larval rearing techniques; pathology and site selection, water quality and human health issues are among the topics to be covered. This is a required course for UMaine Aquaculture majors. Dr. Chris Davis is the instructor. UMaine accredited.

Developmental Biology Teaching Workshop
June 22-25. Get hands-on experience working with organisms commonly studied in developmental biology teaching laboratories. This course is for new and experienced developmental biology teachers wishing to diversify their laboratory lessons. Work will include teaching lab applications on sea urchins and sand dollars, chick embryos, protists, Hydra, planaria, fresh water oligochaetes, ferns, and flowering plants. Dr. Leland Johnson,

Molecular Approaches to Invertebrate Zoology
July 6 to 9. This course, designed for faculty and graduate students, will focus on protein extraction, preparation and separation by native & SDS gel electrophoresis and subsequent Western blot analysis. Methods will be demonstrated and then students will be guided through a hands-on application of the procedures using representative samples prepared from local invertebrates. Western blots will probed with commercially available antibodies; detection methods to be demonstrated will include traditional (colorimetric) and state-of-the-art (enhanced chemiluminscent) alternatives. Participants may bring samples of their own origin for on-site analysis. Dr. Michael Horst from Mercer University School of Medicine is the instructor.

Summer Internships

Undergrads--immerse yourself in marine science! With an NSF REU fellowship or a SURE internship, you can work at the DMC alongside faculty, graduate students and postdocs in a variety of marine science fields. Stipend range from $2600 (SURE) to $3820 (REU). Applications due: February 15, 2005.

Information & applications at www.dmc.maine.edu