# Making Waves

At The University of Maine's Darling Marine Center

1865 THE UNIVERSITY OF MAINE

## Ocean Term, A One-of-a-Kind High School Experience!

The DMC is proud to host an exciting new program called *Ocean Term*—the nation's first semester-long, residential marine science program for high school students. *Ocean Term* will take 32 sophomore girls from Maine and across the country, give them a good dose of basic high school core courses like history, math, English, French or Spanish, and then immerse them in marine science!

The *Ocean Term* endeavor is a unique partnership between Kieve Affective Education, Inc. and the The University of Maine/Darling Marine Center. Kieve will supply the education and the DMC will provide state-of-the-art classroom and laboratory facilities.

Kieve
Ocean Term
A Semester School for Sophomore Girls

This is an exciting time of growth and new directions at the DMC. *Ocean Term* will provide a new dimension to DMC programming, which is currently geared to undergraduate and graduate students, professors, and research scientists. Fear not, the DMC will continue to offer all of it's regular programming, including summer courses and undergraduate internships. We will also continue to welcome college groups and visiting scientists throughout the year.

For more information, contact Ocean Term Director Pam Erickson at 207-563-5172, or visit Kieve's web site, www.keive.org.

## From the Director's Desk:

If I've learned anything from being a marine laboratory administrator, it's that demand for well-equipped field stations is stronger than ever. Field stations play a unique role in enhancing the productivity of both faculty and students by providing them with a "window to the sea" for their research and educational needs.

As I begin my 14th year as Director and as the Darling Marine Center approaches its 40th anniversary, it's an appropriate time to assess our progress. Over the last decade, we have invested over $12-million in new buildings and facility improvements and 2004 will see the addition of a new library and a fourth classroom. However, the most exciting change has been the explosive growth in educational and research programs and the dramatic increase in resident and visiting personnel.

The Center is now home to 15 Ph.D-level scientists from the School of Marine Sciences, the most in its history. Their research continues to be cutting edge and world renown, and draws $2-3 million annually from a variety of funding agencies. Additionally, the Center also serves the needs of another 15 Orono-based faculty on a part-time/seasonal basis. The number of visiting scientists, visiting colleges, summer interns, course participants, and conference attendees have all undergone huge increases, resulting in new collaborations and increasing productivity.

A decade ago the summer season was by far our busiest. By the end of next year, the Center's resident population will have nearly tripled to over 100 people from a decade ago. The entire calendar will be filled with

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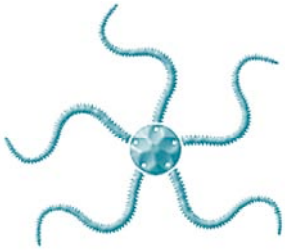
*Continued from page 1.*

activities resulting in a maximum use of our facilities and the need to provide year-round food service in our dining hall for the first time.

Field stations can play a special role in exposing K-12 students to the marine realm and the joys of science. In 2004, the Center will significantly expand its educational mission by hosting *Ocean Term*, the nation's first residential high school marine science program, a unique partnership between The University of Maine and Kieve Affective Education, Inc. This program will be a departure from the traditional role of most university marine laboratories. For the first time, high school students recruited nation wide will live on site and study marine science at a premier field station in a semester-long program.

If the past is any indicator, I fully expect the Center to continue to enlarge its mission to serve an expanding global community of marine scientists, educators, and students. This and future issues of Making Waves will keep you up to date on our progress.

*Kevin*

## Dr. Schnitker Retires

Dr. Detmar Schnitker has retired from The University of Maine after 33 years of teaching and research as a Professor in Geological Sciences/Institute for Quaternary Studies and in the School of Marine Sciences.

Detmar received his Ph.D. from the University of Illinois in 1967 and was hired by the University of Maine in 1969. He was one of the original Oceanography faculty members to be based at the Darling Marine Center.

Detmar's research interests included geological oceanography, paleooceanography and micropaleontology, specializing in foraminifera. He was particularly interested in the evolution of global deep-water circulation patterns and the postglacial evolution of the Gulf of Maine from an ice-shelf covered area, to a calving bay, to an enclosed marginal sea, and finally to the present-day, highly productive body of water.

All the best Detmar!

## New Dual Degree Program Launched

The *Marine Science and Policy Dual Degree Program* was launched by UMaine's School of Marine Sciences in the spring semester. This new graduate program is intended for students interested in the application of science to public policy. The course of study is three years long and leads to two master's degrees: one in marine science (specializing in oceanography, aquaculture or marine biology) and one in marine policy. Currently 14 students are enrolled in the program. Some are based at the Orono campus. Others are based here at the DMC.

The *Marine Science and Policy Dual Degree Program* is supported by a grant from the Kendall Foundation which provides stipends and expenses for about one-third of the students. Other students are supported by faculty grants and UMaine assistantships. More information about the program can be found at http://www.ume.maine.edu/~marine/DualDegree/home.html.

## Joins Editorial Board

Dr. Kevin Eckelbarger has joined the Board of Editors of the international journal, *Invertebrate Reproduction & Development*. He will be reviewing submitted manuscripts in the area of reproductive ultrastructure.

**Darling Marine Center**

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Dr. Kevin J. Eckelbarger, Director
Tim Miller, Laboratory Manager
Linda Healy, Science Writer & Events Coordinator

## King's Appointment

Dr. Gary King has been appointed Chair of the American Society for Microbiology's Environmental Committee. The American Society for Microbiology (ASM) is the world's largest organization of microbiologists. ASM's Environmental Committee provides information to the public and to policy makers on the impact of microorganisms on such environmental issues as climate change, water and air quality, and bioterrorism. The Committee also provides input to regulatory agencies such as the Environmental Protection Agency.

## Recent Publications


**Annis E.R.**, C.B. Cook, 2002. Alkaline phosphatase activity in symbiotic dinoflagellates (zooxanthellae) as a biological indicator of environmental phosphate exposure. Mar. Ecol. Prog. Ser. 245:11-20.

Cook C.B., E.M. Mueller, M.D. Ferrier, **E. Annis**. 2002. The influence of nearshore waters on the corals of the Florida reef tract. In: J.W. Porter , K.G. Porter (eds) The Everglades, Florida Bay, and Coral Reefs of the Florida Keys: an Ecosystem Sourcebook. CRC Press, Boca Raton, pp. 771-788.

**Giessing, A.M.B**., **L.M. Mayer**, and T.L. Forbes. 2003. 1-Hydroxypyrene glucuronide as the major aqueous pyrene metabolite in tissue and gut fluid from the marine deposit-feeding polychaete *Nereis diversicolor*. Environmental Toxicology and Chemistry 22:1107-1114.

**Giessing, A.M.B**., **L.M. Mayer**, and T.L. Forbes. 2003. Synchronous fluorescence spectrometry of 1-Hydroxypyrene: A rapid screening method for identification of PAH exposure in tissue from marine polychaetes. Marine Environmental Research 56:599-615.

Hart, M.W., M. Byrne, & **S.L. Johnson**. 2003. *Patiriella pseudoexigua* (Asteroidea: Asternidae): a cryptic species complex revealed by molecular and embryological analyses. J. Mar. Biol. Ass. U.K. 83:1109-1116.

Kringel, K., **P.A. Jumars** and D.V. Holliday. 2003. A shallow scattering layer: High-resolution acoustic analysis of nocturnal vertical migration from the seabed. Limnol. Oceanogr. 48:1223-1234.

Smoot, J.C., **L.M. Mayer**, M.J. Bock, P.C. Wood, and R.H. Findlay. 2003. Structures and concentrations of surfactants in the gut fluid of the marine polychaete, *Arenicola marina*. Mar. Ecol. Prog. Ser. 258:161-169.

**Steneck, R.S.**, M.H. Graham, B.J. Bourque, D. Corbett, J.M. Erlandson, J.A. Estes and M.J. Tegner. 2002. Kelp forest ecosystem: biodiversity, stability, resilience and their future. Environmental Conservation 29(4):436-459.

**Steneck, R.S.**, P.A. Kramer and R.M. Loreto. 2003. The Caribbean's Western-most Algal Ridge in Cozumel, Mexico. Coral Reefs 22:27-28.

**Voparil, I.M.**, **L.M. Mayer**, A.R. Place. 2003. Solubilization interactions among contaminant and nutritional lipids in digestive fluids from marine invertebrates. Environmental Science and Technology 37:3117-3122.

**Yund, P.O.**, and S.K. Meidel. 2003. Sea urchin spawning in benthic boundary layers: Are eggs fertilized before advecting away from females? Limnol.Oceanogr. 48:795-801.

R awson, P.D., Slaughter, C., and **P.O. Yund.** 2003. Patterns of gametic incompatibility between the blue mussels *Mytilus edulis* and *M. trossulus*. Mar. Biol. 143:317-325.

Newlon, A.W. III, **Yund, P.O.**, & J. Stewart-Savage. 2003. Phenotypic plasticity of male, female, and asexual reproduction in a colonial ascidian, *Botryllus schlosseri*. J. Exp. Zool. 297A:180-188.


## In Memory of

We are sad to report that Vernon Westcott, a long-time friend of the Darling Marine Center, passed away in September. Vernon was a summer resident of South Bristol who helped the Center in many ways, including donations, sharing his summer residences with visiting investigators, and enthusiastic encouragement of scientists working at the Center. His bright, optimistic cheer will be missed.

Vernon's career focused on technology development, which was accompanied by an intense interest in many fields of science. Early in his career he helped develop an instrument called a ferrograph, for detection of wear and tear in machines such as jet engines. Later he was to apply the same principles to detection of particles in biological systems, such as wear particles in arthritic joints and even to the detection of pathologies such as cancer.

One of his hobbies was microscopy, because it reveled in the wonders of the tiny world. He therefore established the first electron microscopy laboratory at the DMC in 1978 by donating a Coates and Welter scanning electron microscope. We will remember his dedication to this view of the world by naming this lab the *Westcott Electron Microscopy Facility*.

# Masters Accomplished, Ph.D.'s Pursued

Anne Simpson and Leslie Taylor were both awarded Master's degrees this year and elected to further their educations by pursuing Ph.D.'s. Congratulations!

## Anne Simpson, M.S. Oceanography

Working with Dr. Les Watling, Anne studied the effects of commercial shrimp trawling on the habitat and macrofaunal community structure of mud-bottom fishing grounds. She found that seasonal shrimp trawling disturbance produced short-term (<6 months) changes in infaunal community structure, but did not appear to result in long-term cumulative changes.

Interestingly she also found that megafauna such as lobsters, fishes and brittle stars cause a high level of sediment disturbance on these muddy bottoms. The constant disturbance appears to maintain macrofaunal communities in a perpetually low successional state, thereby potentially minimizing trawling impacts.

Anne has decided to stay in the Watling lab and pursue a Ph.D. focusing on the taxonomy of octocorals. Octocorals are non-reef building corals that are found all over the world. Anne's research will be the deep-water octocoral genera found in the Northwest Atlantic and the Aleutian archipelago.

Octocorals are hard to identify to species because their external morphology can be variable. Previous taxonomic studies have tried to separate species based on the shape of their sclerites (small calcium carbonate plates in coral tissues) or by their DNA, but the results do not agree. Using electron microscopy, Anne hopes to determine the phylogenetic relationships of these corals by looking at the characteristics of reproductive cell ultrastructure.

Turn to page 10 to read more about the undersea explorations of Anne and Les as they search for octocorals in the Gulf of Maine.

## Leslie Taylor, M.S. Oceanography

Several invertebrate species living on or in bottom sediments emerge nightly, swimming into the water column to feed or reproduce. Leslie Taylor, working with Dr. Pete Jumars, studied emergence patterns in the Damariscotta River Estuary.

Using an acoustic profiler mounted on the sea bottom and looking upwards in approximately 10 meters of water, Leslie looked for evidence of emergence events. The acoustic data revealed patterns of emergence on most evenings, beginning around dusk and ending just prior to dawn. Emergence-trap samples show that the acoustic signal was dominated by the mysid *Neomysis americana* and the shrimp *Crangon septemspinosa*.

Leslie also noted nocturnal emergence events that coincided with tide phases on both the ebb and flood tides. These events occurred shortly after the highest local current speeds, as tidal currents began to decelerate. Similar daytime emergence events were also seen in the acoustic data, but at much lower magnitudes. Leslie's work suggests that emergence events in environments with strong tidal currents, like the Damariscotta River, may be more complex than previous non-acoustic studies indicated.

Leslie is continuing her emergence research for her Ph.D. looking at the spatial extent of emergence and the on-shore/offshore component of the behavior.

# Ian Voparil, Ph.D. Oceanography

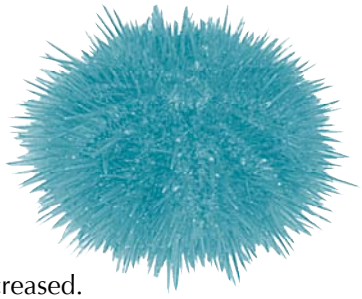
Ian Voparil successfully completed his Ph.D. in Oceanography upon the defense of his thesis research *Lipid Digestion by Marine, Benthic Invertebrates*. Ian worked in Dr. Larry Mayer's lab which has long been studying the bio-availability of nutritional and toxic materials in marine sediments.

Working primarily with the marine worm *Nereis virens,* Ian learned how deposit feeders process the sediment they eat. In a nutshell, the process goes as follows. Deposit feeders burrow through the sea floor ingesting sediments as they go. Micelles, hydrophyllic particles within the deposit feeder's gut, mobilize lipids from the sediment matrix and transport them through the aqueous gut environment. As the micelles/lipid compounds travel through the gut, enzymes digest the lipids—some of which are absorbed into the animal, while others are excreted with the remaining sediment.

The presence of micelles in gut fluid are key to the mobilization of lipids. Lipids come in many forms; some have nutritional value and others are toxic. Many anthropogenic pollutants, such as polycyclic aromatic hydrocarbons (PAH) from oil spills, diesel soot and old tires fall into the toxic category.

Having dissected many worms to extract their gut juices, Ian decided that there had to be a better way. He successfully developed a "cocktail" of commercially available compounds to mimic the gut fluids of *Arenicola marina*. Using this ready supply of "gut fluids" Ian incubated contaminated sediments in the cocktail and measured the contaminant's that "dissolved" in the mix. In this way, Ian was able to measure the digestive exposure of the pollutants in sediment. He ultimately determined that the bioavailabilty of PAH's is greater than previously believed.

Ian has since moved to the west coast and has a postdoc position at UC Santa Cruz studying dissolved organic matter (DOM) in deep water in the Pacific and in hydrothermal vent fluids from Endeavour Ridge. The project aims to understand the potentially different rates of cycling for proteins, carbohydrates, lipids, etc. within the DOM using natural abundance.



# John Vavrinec, Ph.D. Oceanography

Green sea urchins (*Strongylocentrotus droebachiensis*) are common in the subtidal coastal waters of Maine, however their numbers were far greater prior to 1986 when aggressive harvesting for the Japanese sushi market commenced. Using Marine Protected Areas, or fisheries closures, John studied the potential of urchin stock recovery, taking into account such factors as urchin life history, larval transport/supply and community ecology. His advisor was Dr. Bob Steneck.

John was able to document and quantify changes in community structure as urchin numbers decreased. He reported that when urchins are present the steady state is based on a corraline community because grazing urchins keep fleshy macroalgae, such as kelp, to a minimum. As urchins are harvested, the macroalgae takes over and creates a steady state less hospitable to the urchin population. John found that Marine Protected Areas were ineffective in areas where the steady state had shifted from corraline to macroalgal communities.

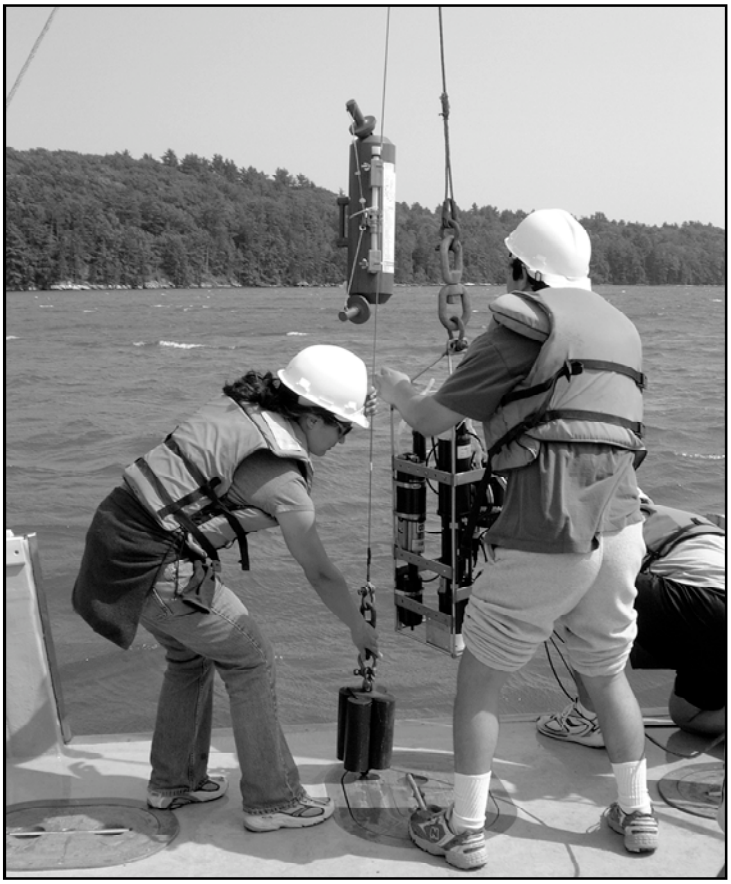
John also reported interesting finds relating to urchin life history, settlement and recruitment. These include the fact that competent urchin larvae, echinoplutei, metamorphose in the water column and position themselves higher in the water column thereby taking advantage of wind-driven, downwelling events for settlement.

John is now a postdoctoral fellow at the NOAA's NMFS Northwest Science Fisheries Center in Seattle, Washington looking at the habitat-specific use and survival of juvenile English sole (and associated community) in Washington estuarine bays. The data will be used to determine if the introduced sea grass species, *Spartina* and *Zostera japonica* have affected fish production. The data will also be used to provide information for the management of the fish.

# Making Sense of Optical Ocean Observations

Optical sensors collect such data as chlorophyll, dissolved organics, and suspended particulate matter. The sensors can be mounted on platforms including satellites, ships, moorings, drifters, gliders, and autonomous vehicles. The integration and interpretation of optical ocean data is analytically challenging and requires powerful statistical tools because the data vary considerably on spatial and temporal scales.

Dr. Mary Jane Perry (pictured right) identified the need for oceanographers, statisticians and modelers to work together to solve such problems and developed a five-week cross-disciplinary course combining the fields of optical oceanography and spatio-temporal statistics.



The course, **Spatio-Temporal Statistical Analysis of Multi-platform Optical Ocean Observations**, was held at the DMC this summer and drew graduate students from all corners of the world. Course participants collected optical data explored various graphic and modeling methods to compare and contrast the data. Instructors and guest lecturers included:

Dr. Mary-Kate Beard Tisdale, UMaine
Dept. of Spatial Information, Science & Engineering

Dr. Andrew Thomas
UMaine, School of Marine Sciences

Dr. Emmanuel Boss
UMaine, School of Marine Sciences

Dr. Collin Roesler, Bigelow Laboratory for Ocean Sciences

Dr. Thomas Windholz, GIS Training & Research Center,
Idaho State University

Dr. Gerard Heuvelink, Wageningen University,
The Netherlands

Dr. John Welhan, Idaho State University

Dr. Phaedon Kyriakidis, Univ. of California, Santa Barbara.

The course was made possible with complete funding from the National Science Foundation.

## Conferences & Courses at the DMC!

The Darling Marine Center is the perfect venue for your next scientific conference or educational workshop.

We have comfortable meeting space as well as flowing seawater classrooms and laboratories suitable for hands-on workshops. In the immediate vicinity we have a wide variety of marine ecosystems, everything from calm mudflats to exposed rocky headlands. To top it off, we offer a variety of housing options, great food and beautiful scenery.

For more information contact our Conference Coordinator at 207-563-3146, ext. 200 or by e-mail at lhealy@maine.edu

## Exploring the Silver Wake

The silver wake is a shimmering trail of bioluminescent phytoplankton often seen behind boats at dusk.

The Silver Wake Institute was a marine education program for middle and high school teachers that convened at the DMC this summer. It was designed to help teachers boost their science curriculum and engage students in the study of Maine's coastal waters.

The workshop focused on the collection and identification of phytoplankton and learning about its role in marine food webs. Related topics and activities included acquiring and using satellite imagery, and discussing human health and local policy issues pertaining to the toxicity of harmful algal blooms known as red tide. Teachers were provided with classroom resources and material for curriculum development. Throughout the school year, the group will have several follow-up sessions to exchange ideas and lesson plans.

The Silver Wake Institute was developed by Dr. Sara Lindsay, UMaine School of Marine Sciences, and Esperanza Stancioff, UMaine Cooperative Extension and Maine Sea Grant. It was made possible with funding from the U.S. Environmental Protection Agency. Details about the Silver Wake institute can be found at http://www.ume.maine.edu/ssteward/silverwake.htm.

## The Maine Phytoplankton Monitoring Program

Coastal Maine is lucky to have a very active crew of volunteer water quality monitors participating in the Maine Phytoplankton Monitoring Program. Using plankton nets and field microscopes, volunteers monitor coastal waters for harmful algal blooms, also know as red tides. They are specifically looking for *Alexandrium spp.*, *Dinophysis spp.*, *Prorocentrum lima*, and *Pseudonitzschia spp*. Though shellfish are not harmed by the red tides, they carry the biotoxins up the food chain. The toxins can cause illness or even death to humans who ingest the infected shellfish.

There are currently 80 volunteers in the Maine Phytoplankton Monitoring Program ranging from high school students to retired scientists. They sample 35 sites along the Maine coast on a weekly basis form April to October. Volunteers file monitoring reports with the Maine Department of Marine Resources (DMR). If red tide organisms are identified, DMR's biotoxin team samples shellfish meats to determine the threat to human consumption. If necessary the area is closed to the harvesting of shellfish until the red tide dissipates.

To keep the volunteers on their toes, an annual spring training session is organized by the program's coordinator, Sarah Gladu. For the past several years, the training weekend has taken place at the DMC. The training session is for new and seasoned volunteers. It gives them the chance to learn/review proper sampling techniques and use of their field microscopes, and helps them hone their phytoplankton identification skills.

Program sponsors include: Maine Department of Marine Resources, University of Maine Cooperative Extension, U. S. Food and Drug Administration, Bigelow Laboratory for Ocean Sciences, Gulf of Maine Council on the Marine Environment, and the National Oceanic and Atmospheric Administration. For more information go to: www.ume.maine.edu/ssteward/phyto.htm.

Bioturbation Study

## How Much Mud Can a Mudworm Eat?

How much wood can a woodchuck chuck? Well, how much mud can a mudworm eat—especially if you change the tastiness of the mud? A new, multi-year project, involving the labs of Pete Jumars and Larry Mayer, has started to address this question. The basic question is simple—is there a minimum, critical food content necessary to support the activities of animals that burrow in and eat mud?

This process, called bioturbation, has been studied for many years. Darwin published his last books on the same topic for earthworms, that burrow soil on land, and he closed his career with the comment that "worms have played a more important part in the history of the world than most persons would at first suppose." For the oceanic versions of earthworms, many holes exist in our understanding, including why and how they eat different quantities of mud.

This new project, funded by the Office of Naval Research, will combine laboratory and field studies of bioturbation. In the lab, different animals will be exposed to diets containing different food levels—a study that may one day benefit the emerging industry of worm aquaculture, vermiculture. Eric Weissberger, a new post-doctoral fellow, will spearhead this effort. The mechanics of worm burrowing will be addressed by Kelly Dorgan, a Ph.D. candidate working with Pete Jumars. In the field, seasonal studies are being done along the coast of Maine and in the Gulf of Mexico off Louisiana. They are collaborating with other scientists, such as Dr. B. Boudreau, Dalhousie University, who is developing models of bioturbation, and Dr. David Shull, Western Washington University who is studying how bioturbation may release cysts of red tide organisms.

At the end of the project, the group hopes to improve our ability to predict when, where, and how mud on the seafloor will be mixed. This process is important if we are to better understand processes such as nutrient regeneration from the seafloor and detection of sensors or mines in the mud.

## Dr. Eric Weissberger

Eric's general interests are in marine benthic ecology. He received his Ph.D, at Rutgers University in 1998, for his work on surf clam population dynamics and other indirect species interactions in benthic communities. After graduation, he taught at Drexel University in Philly, PA, and Rowan University in NJ, and worked as an environmental consultant. As a post-doc in the Jumars/Mayer lab, Eric is striking off in a new direction, studying the nutritional control of bioturbation—how much organic matter must there be in the sediment for deposit feeding organisms to feed and consequently mix the sediment.

## Sampling & Sorting

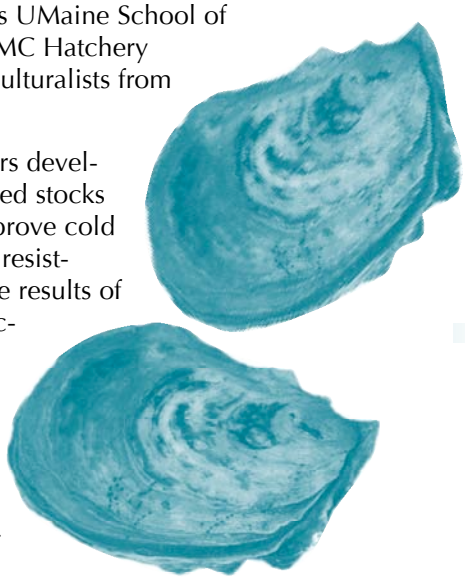
Gulf of Maine samples were collected from Wilkinson Basin in October using a Minimuck multicorer deployed from the DMC's R/V Ira C (pictured above left). The multicore lands softly so as not to disturb the delicate organic layer that "floats" on the seafloor. Core tubes are then hydraulically released to collect a sediment sample (picture left).

Back at the lab, cores are sectioned. Some sections go to Larry's lab for nutritional analysis. Other sections go to Eric, who will sort through the sediments to identify the organisms found there. The nutritional content and the biota will then be compared.

## Fast Growing Oysters For Maine's Cold Waters

The waters of the Damariscotta River estuary have long been known for delicious cultured shellfish, especially oysters. Beginning in 1986, UMaine researchers and Damariscotta River oyster growers worked together to develop a fast-growing strain of oyster. The resulting strain grew 40% faster than the wild oyster stocks of the Damariscotta River.

In a renewed effort to improve cold water growth performance and disease resistance of the Damariscotta River oysters, the Oyster Brood Stock Program was launched earlier this year. This collaborative study involves UMaine School of Marine Sciences researcher Dr. Paul Rawson, DMC Hatchery Manager Scott Feindel (pictured left), and aquaculturalists from Freeport to Cutler, Maine.



They are comparing the high-performance oysters developed at the DMC since 1986 with selectively bred stocks of oysters from New York and New Jersey to improve cold water growth performance and possibly disease resistance, too. Hybrid crosses will also be tested. The results of this trial will be used to design a long-term selective breeding protocol for improved yield throughout the coastal waters of Maine.

Support for the cooperative Oyster Brood Stock Program project comes from Maine Technology Institute, the Maine Agriculture and Forestry Experiment Station, and donations form the oyster growing industry.

www.gulfofmainefoundation.org
gmf@maine.edu

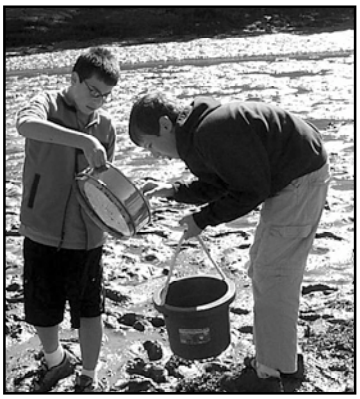


## New Initiative Spurs Joint Collaboration

Gulf of Maine Foundation's summer seminar series and their K-12 marine education program have provided much benefit to the local community in recent years. To broaden the scope of their programs, board member Herbert Sears, Jr. suggested the establishment of an "independent, unbiased place and process to discuss the important issues of the Gulf of Maine coastal region." The result will be a series of forums focusing on current challenges facing Maine coastal communities, the first of which will be held in December 2003.

In this effort the GMF has teamed up with Maine Sea Grant, the Maine Coastal Program, and the Island Institute to present *Working Waterfront Access 2003: A Forum on Challenges and Solutions*. The goal of the forum is to emphasize the value of a diverse waterfront in Maine, and to identify challenges and solutions for waterfront-dependent communities and businesses.

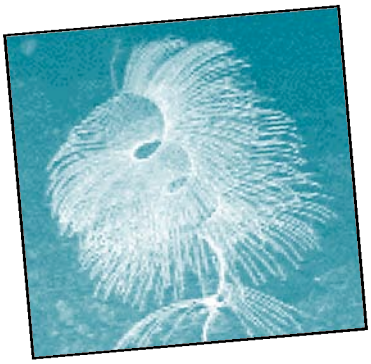
The program includes a special keynote address by Maine Governor John Baldacchi, panel discussions and break out sessions to define the working waterfront and propose access solutions.



## Marine Education Program Thrives

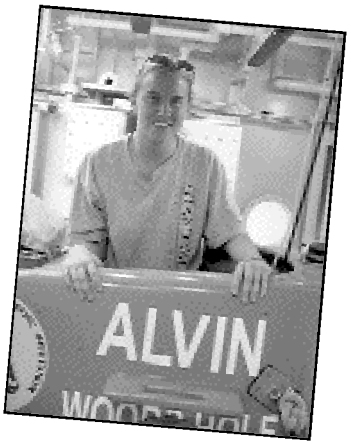
In 2000, the GMF established a K-12 marine education program to bring local school children to the DMC for hands-on marine science classes and field work. The effort has been hugely popular and hailed by teachers, students and parents. As this newsletter goes to press, Jan Faulkner, the GFM Education Coordinator, reports that 674 students from 12 schools and 4 home school groups have visited the DMC this fall.

# Cruisin'

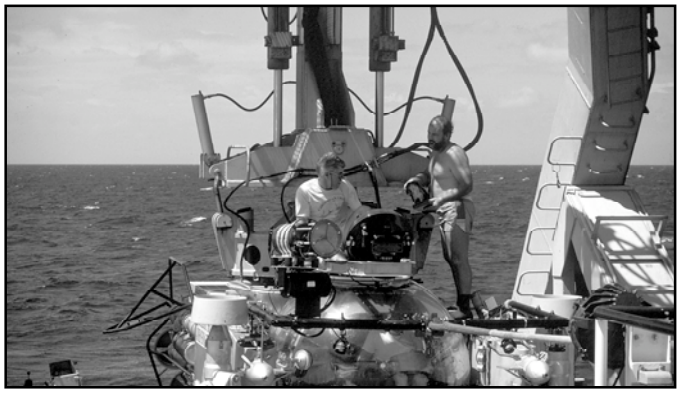


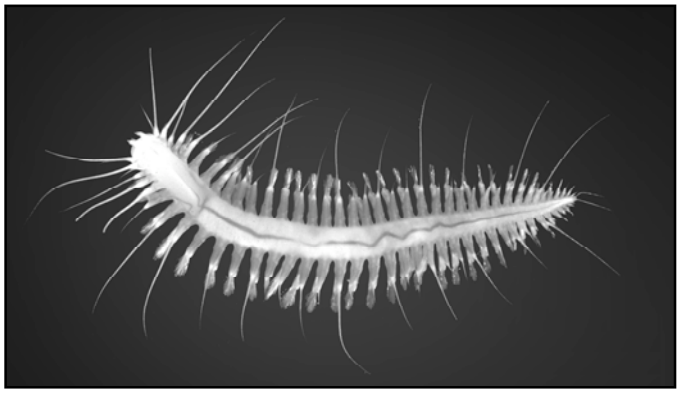
## Cruisin' the Gulf of Maine

Dr. Les Watling and graduate students Anne Simpson and Betsy Grannis (pictured right) participated in two cruises this summer in search of octocorals and associated invertebrates and fish. First, they boarded the R/V Atlantis which took them to the seamounts on the continental shelf just beyond the Gulf of Maine. Using the manned submersible Alvin, dives were made on Bear, Kelvin, and Manning seamounts. The following month they boarded the R/V Connecticut and using a remotely operated vehicle (ROV) searched for and sampled octocorals in Jordan Basin, Truxton Swell, and off Mt. Desert Rock.




Les, Anne and Betsy found octocorals, some over two feet tall and hundreds of years old, in areas where the deep rugged terrain limits bottom trawling. They believe octocorals were more common in the Gulf of Maine prior to extensive fishing pressures.





## Cruisin' the Gulf of Mexico

Dr. Kevin Eckelbarger set out in early November for a 10-day cruise aboard the R/V Seward Johnson II. The purpose of this NOAA-NURP funded project was to study the reproductive ecology of cold-seep invertebrates in the bathyl waters of the Gulf of Mexico.

Cold-seep environments are characterized by concentrations of methane and sulfides that would be poisonous to most organisms, yet a thriving community of unique deep-sea invertebrates are found there.

One of the dominant organisms at these seeps is *Lamellibrachia sp.*, a tubeworm whose longevity has been estimated at more that 200 years. This animal is believed to be among the most fecund in the ocean and may play a key role in the deep-sea ecosystem. Numerous other species of polychaetous annelids, including the iceworm, *Hesiocaeca methanicola* (pictured bottom left), and molluscs such as *Bathymodiolus childressi* (pictured middle left) also thrive at the seeps.

The scientific crew included researchers from the University of Oregon, Penn State, University of Virginia, and the Smithsonian Institution, as well as the University of Southampton (Britain) and Norway. All were interested in learning more about the biology of these unusual organisms. Using the Johnson Sea Link submersible (pictured top left) they dove to depths of 3,000 feet to collect animals living on or near the seeps.

Kevin is particularly interested in how the reproductive biology of these organisms has adapted to the unique methane seep environment. Using transmission electron microscopy, he will study the reproductive tissues of collected animals to describe gametogenesis (sperm and egg formation) and to determine, if possible, the rate of gamete production. His previous research has demonstrated that some features of reproductive systems often provide evidence as to how these organisms have evolved unique reproductive adaptations that make them successful in extreme environments.

## Cruisin' the Straight of Juan de Fuca

Dr. Mark Wells and two graduate students, Lisa Pickell (pictured right) and Sheri Floge (pictured far right), participated in a three week cruise in the northwest pacific, along the Washington Coast and British Columbia's Vancouver Island.

The project was ECOBHAB PNW or the Ecology of Harmful Algal Blooms in the Pacific Northwest. The focus of the study was the physiology, toxicology and ecology of the toxic diatom *Pseudo-nitzschia*.

Pseudo-nitzschia produces domoic acid (DA) which works it's way up the food chain by accumulating in razor clams and Dungeness crabs and ultimately poisoning pelicans, cormorants, sea lions and humans.

Interestingly, Juan de Fuca eddy appears to initiate algal blooms, retain DA, and transport the toxin to west coast beaches.

Aboard the University of Oregon's R/V Wacoma, researchers measured the physical, chemical and physiological conditions under which the algae *Pseudo-nitzschia* blooms in the Juan de Fuca eddy. They also looked for clues as to transport mechanisms that bring the DA to the coastal area.

For more information about the project, go to www.ecohabpnw.org



## New Nanoscale Device Measures Biologically Available Iron

With support from the National Science Foundation Dr. Mark Wells and Dr. Karen Orcutt (pictured right) are working to develop a new tool for measuring the supply of iron to phytoplankton in marine systems--something that has never been done before!

Iron plays an important role in marine systems. To phytoplankton, iron is an essential micronutrient. Iron is present in seawater in many different forms, however, only some forms are useable, or bioavailable, to phytoplankton. It is the bioavailable iron that determines where phytoplankton grow and which species are in the phytoplankton assemblage.

Working on an exploratory research grant, Karen and Mark developed a nanoscale device called a liposome to measure the supply of bioavailable iron. A liposome is a synthetic cell engineered to mimic a phytoplankton cell. Using 59Fe, a radioactive iron isotope, they can quantify the amount of iron that is taken into the cell.

The next step in the project is to make the liposomes easier to work with by making them more robust. Then the researchers want to calibrate the liposome uptake to real phytoplankton, specifically the phytoplankton in the Damariscotta River.

Colleagues Dr. D. Whitney King, Colby College, and Dr. Carl Tripp, UMaine will also be involved. Dr. King is responsible for developing chemiluminescent detection of iron within the liposome—creating a smart device—rather than using more cumbersome radioactive tracers. Dr. Tripp will use vibrational spectroscopy to further study the transport of the iron complex across the liposome membrane.

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