Making Waves

At the Darling Marine Center

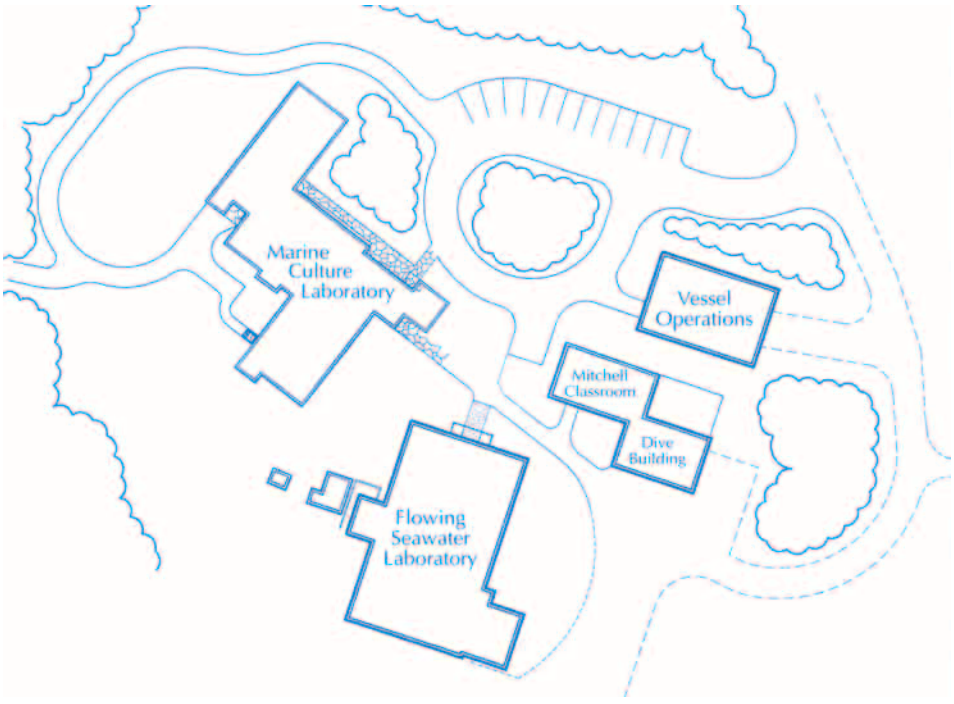
Another Building Spawns at the DMC

A new $2.5-million Marine Culture Laboratory (MCL) is currently under construction at the DMC. The MCL will be located a stone's throw away from the existing Flowing Seawater Laboratory (FSL) on the Center's waterfront and will support the expansion of several research programs.

The new two-story building will provide the necessary resources, space and equipment for three new directions of marine research: the study of ocean phytoplankton and optical oceanography, the study of genetics and diseases in aquaculture species, and the culture of living cold water species. It will also include a much-needed 30-student flowing seawater classroom and molecular biology laboratory.

The flowing seawater system in the new wet lab will double the Center's current capacity to raise living marine organisms and it will be the most advanced system available in the state of Maine. The new wet lab will have chillers built into the seawater system, allowing researchers to maintain cold, deep-water species for observation, life histories studies and experimentation. This chilled seawater system compliments the existing seawater system in which heat exchangers make it possible to maintain summer seawater temperatures year-round for aquaculture research. In addition to holding tanks and aquaria, the wet lab area will also include an algal culture room, and research bays for visiting scientists.

The MCL ground breaking ceremony drew campus dignitaries, and state representatives including (from left to right): Dr. Kevin Eckelbarger, Director, Darling Marine Center; Dr. Bruce Barber, School of Marine Sciences; State Senators Marjorie Kilkelly and Mary Cathcart, University of Maine President Dr. Peter Hoff, and State Representative Ken Honey



DMC waterfront site plan including the Marine Culture Facility as designed by Weinrich and Burt Architects of Damariscotta.

A wing of the new building will be dedicated to Dr. Mary Jane Perry's phytoplankton research. In addition to lab and office space, the Perry lab will include walk-in artificial environmental chambers, and a radioisotope laboratory.

The new classroom will be equipped with teleconferencing equipment allowing live, interactive broadcasts to all major marine institutions in Maine. The classroom will support University of Maine marine courses as well as those taught by the 26 visiting colleges and universities who use the Center's facilities each year.

Funding for the new laboratory came from a from a variety of sources including the National Science Foundation, the Maine Science and Technology Foundation, the University of Maine, and the State of Maine's Research and Development Bond Issue. Project completion is expected by May 2001.

Our New Research Vessel

Captain Hig at the wheel.

The R/V Ira C.

It's true, Captain Hig loves his new boat. It's everything he ever dreamed — energy efficient, safe, perfect for teaching and research.

The 42' R/V Ira C. resembles a Maine lobster boat, and with good reason. A fishing boat has lots of deck space and is equipped with pot haulers and A-frames, the same equipment necessary to deploy and retrieve a myriad of oceanographic sampling gear. This was our template for designing the vessel.

The Ira C. has a fiberglass Wesmac hull which was finished-off by our neighbors at Flowers Boatworks, right here in Walpole. It has a 510hp Volvo diesel engine, 8KW diesel generator and all the latest safety devices: EPIRB, GPS, radar, depth sounder, VHF and side band radios, and two 6-man life rafts.

It has a top cruising speed of 18-19 knots (about 21 miles per hour) and fuel capacity for a three day trip.

For research, the spit wheel house has an extended cabin with both wet and dry lab space. There's plenty of room on deck for working with gear and processing samples, and there is a 70 gallon live well in the after deck. A dive door gives easy access to the water for SCUBA research. There are four berths in the fo'c's'le, a shower in the head, and a small galley.

This winter an articulating A-frame and two deck winches, each capable of handling 150 fathom (900 feet) of wire, will be added to the vessel.

The Ira C. hit the water in late August. It's first job was as a dive platform for naval historians and archeologists diving on the wrecks of the scuttled Penobscot Expedition in the upper reaches of Penobscot River. The R/V has also been used extensively this fall by the Semester-by-the-Sea program (page 3) and by many visiting college groups.

To charter the R/V Ira C. for your research, contact Captain John Higgins.

Dr. Kevin Eckelbarger, DMC Director, Dr. Bruce Wiersma, Dean of the College of Natural Sciences, Forestry and Agriculture, Captain John Higgins and Robbie Downs, DMC Safety officer, take the new vessel for a test drive.

Darling Marine Center • University of Maine

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e-mail: darling@maine.edu

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

Climb aboard!

SBS students spend a semester in residence at the DMC to work more closely with faculty and to take advantage of a different kind of learning experience.

This fall SBS students are experimenting with flumes, sampling the ocean floor, conducting archeological surveys and learning about human influences on the ocean.

Semester-by-the-Sea meets degree requirements for the University of Maine's, School of Marine Sciences. The program is open to students from any UMaine campus, as well as other academic institutions.

For information about SBS 2001, contact Dr. Jim McCleave at mccleave@maine.edu, or by phone at 207-581-4392.

Students in Dr. Pete Jumars' *External Design of Marine Organisms* class use a flume to learn how momentum, mass and information are transferred to and from organisms in the sea. The course emphasizes small-scale and low Reynold's number fluid dynamics and molecular diffusion and their influence on design of body plans and sensory systems.

SBS students study alongside graduate students in the *Invertebrate Biology* taught by Drs. Kevin Eckelbarger and Les Watling. In addition to taxonomy, the course emphasizes identification and comparative morphology of the critters that live along the Maine Coast. Collecting trips to rocky headlands, sandy beaches and mud flats, and aboard the Ira C. introduce students to a broad array of sampling techniques and a vast number of animals.

This fall's SBS curricula also includes an interdisciplinary course called Human Influences on the Ocean, team taught by Drs. Larry Mayer, Mary Jane Perry, Mark Wells and Joe Kelly. In this course, students learn to assess what human activities can actually change how the oceans work. They learn to determine original conditions, establish cause and effect, and how further human activities (including cessation or remediation) will cause the oceans to change in the future.

Rounding out the program is a *Maritime History and Archeology of New England* course taught by Dr. Warren Riess, and tying it all together is a seminar class taught by Dr. Gary King.

Pete Jumars Elected President of ASLO

Dr. Pete Jumars

Dr. Pete Jumars is the new President-elect for the American Society of Limnology and Oceanography (ASLO).

ASLO is a professional society whose mission is to promote research in the fields of limnology and oceanography, and to foster the exchange of information across the range of aquatic sciences. ASLO is best known in the scientific community for its journal, Limnology and Oceanography (L&O), its interdisciplinary meetings, and special symposia. It has been said that serving on the Board of Directors for ASLO has been described as "one of the best and most rewarding" ways to serve the science community.

Jumars believes the "most durable" goal of ASLO is the dissemination of reliable scientific information about aquatic ecosystems. By encouraging the organization to play a greater role in aquatic science education below the graduate level, Jumars hopes to increase the "literacy and interest" in science among non-scientists and young people. Along these lines, he would like to see the ALSO office in Washington, DC, become a reputable source of scientific information on current environmental issues for political lobbyists.

To learn more about ASLO visit their web site at http://www.aslo.org

North American Echinoderm Conference

Darling Marine Center ◆ University of Maine
August 22-26, 2001

The 4th North American Echinoderm Conference (NAEC) will be held August 22-26, 2001 at the DMC. This four-day conference will be a great opportunity for echinoderm biologists from a broad array of fields to exchange their recent research findings in a stunning location. The event will feature keynote addresses by Drs. John Pearse, Paul Tyler, Craig Young and John Dearborn as well as sessions of oral and poster presentations.

Complete conference information including travel information and registration material can be down loaded from the DMC web site at http://server.dmc.maine.edu. If you would prefer to receive this material in printed form, please contact Linda Healy at lhealy@maine.edu or by phone at 207-563-3146, extension 200.

Recent Publications

Chen, Z., L.M. Mayer, C. Quétel, O.F.X. Donard, R.F.L. Self, P.A. Jumars, and D.P. Weston. 2000. High concentrations of complexed metals in the guts of deposit-feeders, Limnology and Oceanography, 45:1358-1367.

Gerken, S., **L. Watling**, A. Klitgaard. 2000. Some contumacious Cumacea from Arctic waters. Journal of Crustacean Biology 20:31-43.

Hodgson, A.H. and **K.J. Eckelbarger**. 2000. Ultrastructure of the ovary and oogenesis in six species of patellid limpets (Gastropoda: Patellogastropoda) from South Africa. Invertebrate Biology 119: 265-277.

Johnson, W.E., P. Stephens & **L. Watling.** 2000. Reproductive biology of peracarid crustaceans. Advances in Marine Biology, 39:105-260.

Jumars, P.A., J.E. Eckman and E. Koch. 2000. Animals and plants in benthic flows. pp. 320-347 in B. Boudreau and B.B. Jørgensen, Eds. The Benthic Boundary Layer: Transport Processes and Biogeochemistry. Oxford Univ. Press, NY.

Milligan, P. and **G.M. King**. 2000. Carbon monoxide production by nitrogen-fixing bacteria is not enhanced by nitrogenase activity. Microbiol. Ecol. 34/2:157-160.

Namba, K. and **G.M. King**. 2000. Response of Atmospheric Methane Consumption by Maine forest soils to exogenous aluminum salts. AEM 66:3674-3679

Petrescu, I. & **L. Watling**. 1999. Revision of genus *Americuma* Watling, 1991 (Crustacea, Cumacea) with the description of *Styloptocuma heardi* (Bacescu, 1979) based on neotype material. Travaux du Museum National d'Histoire naturelle "Grigore Antipa", 41: 299-308.

Schories, D., Anibal, J., Chapman, A.S., Herre, E., Isaksson, I., Lillebo, A.I., Pihl, L., Reise, K., Sprung, M. and **M. Thiel**. 2000. Flagging Greens: hydrobiid snails as substrata for the development of green algal mats (*Enteromorpha* spp.) on tidal flats of North Atlantic coasts. Mar. Ecol. Prog. Ser. 199: 127-136.

Watling, L., F.R. Schram & C.H.J. Hof. 2000. The place of the Hoplocarida in the malacostracan pantheon. Journal of Crustacean Biology 20 (Special Number 2): 1-11.

Yund, P.O. 2000. How severe is sperm limitation in natural populations of marine free-spawners? Trends Ecol. & Evol. 15:10-13.

Mark your calendar
Make travel plans
Come to Maine!

Alumni Day '01

It's been six years since we were all together — and that's too long!

Come see the new dorm, the new Marine Culture Laboratory and the new R/V Ira C.

Play volleyball, hike the trails and EAT LOBSTER

Saturday July 21

Details will be posted on our web site at
http://server.dmc.maine.edu

Ph.D. in Oceanography Awarded

Sarah Gerken has been awarded a Ph.D. in Oceanography from the University of Maine. Working under Dr. Les Watling at the Darling Marine Center, Sarah studied oceanography and taxonomy.

Her dissertation is a taxonomic monograph of a family of crustaceans called Cumaceans. Often called "comma shrimp," cumaceans are small animals, 1mm-3cm in size, which live in the upper layer of marine sediments or, sometimes, cling to rocks and algae in shallower water.

Using the Descriptive Language of Taxonomy system (DELTA) Sarah also created an interactive key for the identification of these cumaceans. DELTA is an internet-based database system of taxonomic descriptions where people can go to identify plants and animals. The DELTA system is used worldwide for many kinds of organisms including corals, crustaceans, insects, fish, fungi and plants.


Dr. Sarah Gerken

Dr. Gerken is now at Bates College where she has accepted an interim position as Assistant Professor of Biology. She will teach Marine Invertebrate Biology, Oceanography, and Invertebrate Evolution, as well as lead a marine ecology field course.


Kathleen Hardy

Masters Degree in Microbiology Awarded

Kathleen Hardy was awarded a MS degree in Microbiology from the University of Maine for her work with Dr. Gary King on carbon monoxide (CO) consuming bacteria, or carboxydotrophs.

Interested in the role bacteria may play in the balancing of green house gases, Hardy and King hypothesize that bacteria living in soils play a role in keeping atmospheric CO concentrations stable.

Kathleen enriched and isolated carboxydotrophic bacteria from forest soil and studied their efficiency at CO oxidation. She found that unlike all other known carboxydotrophs, this isolate was capable of efficiently utilizing the low levels of CO found in the atmosphere and thus, may play an important role in the consumption of CO by soils.

Further use of the methods of enrichment and isolation developed in this study could lead to the discovery of other CO oxidizers also capable of consuming atmospheric CO.

Kathleen has worked as a Research Associate at the DMC for ten years. This fall she joins the lab of Dr. Mark Wells to pursue more marine related research involving dissolved organic matter and trace metals.

Gulf of Maine Foundation

SURE interns (back row left to right) Marie Eiland, Basma Mohammad, Rachel Schwartz, Quinn Roberts, Shona Mookerjee, (front row, left to right) Aimee Phillippi and Robert Russell. Missing from picture, Aran Mooney.

Summer Undergraduate Research Experience

Each summer the Gulf of Maine Foundation supports undergraduate students through their SURE program. This summer there were seven SURE interns. They came from across the country and from across the Atlantic to work in the labs of DMC faculty.

Marie Eiland, University of Copenhagen
Basma Mohammad, Tufts University
Rachel Schwartz, Bryn Mawr College
Quinn Roberts, University of South Carolina
Shona Mookerjee, Carleton College
Robert Russell, University of Maine
Aran Mooney, University of New Hampshire.

Graduate student Aimee Phillippi was awarded the first ever graduate student assistantship for the SURE program. Aimee met with the interns weekly, coordinated SURE events and played an important technical support role in the Intern Mini-Symposium.

SURE intern Shona Mookerjee worked solely for the GMF on their growing k-12 program. Shona developed lesson plans for intertidal exploration, and introduced a gazillion kids, and several adults, to sea weeds and sea cucumbers.

SURE internships run for ten weeks and include a $2500 stipend. Preference is given to students with a strong science background and an interest in marine research who have completed their junior year in college. Application material for summer 2001 is available on the DMC web site.

The Gulf of Maine Foundation (GMF) is a non-profit corporation founded in 1986 to foster the growth and development of marine studies at the Darling Marine Center.

For more information or to become a member, contact:

The Gulf of Maine Foundation
P.O. Box 185, Damariscotta, ME 04543

Jan Faulkner GMF Education Director

K-12 Education Director

Jan Faulkner was recently hired by the Gulf of Maine Foundation to develop marine programs that connect DMC resources with primary and secondary school students, teachers and community members.

Rather than develop lessons plans randomly, Jan has been working with local teachers to find ways of enhancing their current curricula. She works with the teachers to create classroom activities that complement field trips to the DMC.

This fall several school groups toured the DMC shoreline and facilities. Younger groups were introduced to animals in a touch tank. Older students collected marine life, and observed them in the flowing seawater classroom. One high school group in particular had the opportunity to talk with several DMC graduate students to learn more about advanced education and careers in marine science.

Jan is also working with home school students and hopes to provide teacher training workshops as well. For more information contact Jan directly at 207-563-3146, extension 252.

Interns abound at the DMC

This year 30 undergraduates representing 23 colleges in the United States, Canada, Denmark and Scotland held internship positions at the DMC. Many were part of the SURE or REU programs, others held individual positions with DMC faculty or accompanied visiting scientists.

Brian Kershaw, Westfield State College

Marie Eiland, University of Copenhagen

REU Fellows Amanda Spivak, Ellen Hamann, Ruth Howell, Danielle Mitchell and Kelly Dorgan. Missing form picture: Heidi Crosby.

NSF Funds DMC Interns

Dr. Phil Yund spearheaded the effort to establish a REU program at the DMC. REU is the acronym for Research Experience for Undergraduates, a nationally recognized internship program funded by the National Science Foundation (NSF).

DMC-REU Fellowships combine academic training with hands-on laboratory experience. REU Fellows received training in fundamental scientific skills including hypothesis development and testing, data analysis, and oral and written communication while working on their own independent research project in the labs of DMC faculty.

Six undergraduates participated in the first year of the program. They were:

Heidi Crosby, University of Maine
Kelly Dorgan, University of California, Santa Cruz
Ellen Hamann, Augustana College
Ruth Howell, Middlebury College
Danielle Mitchell, California State University, Long Beach
Amanda Spivak, Bryn Mawr College

There will be eight REU positions available in 2001. Information and application material will be posted on the DMC web site by early December.

2001 REU & SURE Internship Information available online at: http://server.dmc.maine.edu

Above: Dr. Sally Woodin searches Lowe's Cove for bamboo worms.

Above: Graduate student Dierdre Edwards uses a video monitoring system to measure flow rate and tube building activity of bamboo worms.

Left: Dr. Rachel Merz collects bamboo worms with Dr. Sally Woodin and intern Lucy Garcia.

Bamboo Worms

Three distinguished marine scientists recently visited the DMC: Drs. Sally Woodin, University of South Carolina; Flo Thomas, University of South Florida, Tampa; and Rachel Merz, Swarthmore College.

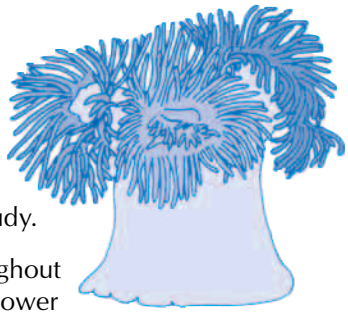
Using their combined knowledge of marine ecology, functional morphology and flow properties, Woodin, Thomas and Merz set out to learn more about the biology and ecology of bamboo worms.

The bamboo worm, *Clymenella torquata*, is a delicate worm measuring 2-3 inches in length and shaped like a bamboo stick. The bamboo worm lives in tubes it builds of fine sediment grains and mucus, and is commonly found in the mud flats of midcoast Maine.

Woodin, Thomas and Merz believe the worm's setae, exterior hair-like projections, are used to build the tubes and function to maintain water flow through the tube. To study these hypotheses, the group collected bamboo worms from Lowes Cove, on the Damariscotta River. After trimming the worms' setae, the researchers used a video monitoring system to conducted flow rate and tube building experiments in the DMC's Flowing Seawater Laboratory.

Preliminary results suggest that bamboo worms use their setae to brace themselves in their tubes while they pump water. As would be expected, the worms were less efficient at maintaining water flow through their tubes after their setae had been trimmed. It is less clear, however, the role setae play in tube building. Interestingly, the worms with shorter setae built larger, wider tubes.

Catch Tentacles



Carsten Roat, Ph.D. candidate at the Kristineberg Marine Station in Sweden, visited the DMC this summer with hopes of finding specialized "catch" tentacles on our local sea anemone, *Metridium senile*, for histological study.

Metridium is a common anemone found throughout the North Atlantic. It is generally found in the lower intertidal zone down to about 90 feet deep. This soft, fleshy animal secures itself to hard substrates like rocks and uses it's feathery tentacles to catch small organisms.

It has been reported that *Metridium* found off the coast of the United Kingdom have "catch" tentacles—longer, finer tentacles with specialized stinging cells. The stinging cells of catch tentacles are used to secure prey and to ward off conspecifics. Carsten has searched Sweden's North Sea coast for anemones with catch tentacles to no avail. He spent the month of July at the DMC doing the same, again with out success.

Carsten presented an informative seminar on the mysterious lack of catch tentacles in some waters, which lead to an interesting discussion about the evolution of such traits. It was suggested that the Gulf of Maine and the North Sea are geologically new bodies of water relative to the Atlantic Ocean, and consequently, their *Metridium* populations there have not yet evolved these specialized cells.

Carsten Roat, Ph.D. candidate at the Kristineberg Marine Station in Sweden examines nematocysts in Metridium *collected in the Damariscotta River Estuary.*

Micro Technologies, Inc. Lobster Project

In recent years lobster pound owners in Maine have reported increased lobster mortality. Bacteria of the genus *Vibrio* have been suggested as the possible cause of mortality. Dr. Cem Giray from Micro Technologies, Inc., an aquatic health laboratory in Richmond, Maine, is conducting experiments at the DMC to determine if *Vibrio* is indeed the pathogen.Over the past two years they have isolated and cultured a number of bacteria from moribund lobsters. Factors such as the virulence, infective dosage, pathogenesis and routes of infection are being tested for each isolate. The project is funded by the Maine Department of Marine Resources.

Pictured left.
Erica James and Dr. Cem Giray of Micro Technologies, Inc.

Sun Sensitive Seaweeds

Dr. Ian Davison of the University of Maine and Dr. Carl Grobe of Westfield State College, Westfield, MA, spent the summer collaborating on a study designed to measure the effect of ultraviolet radiation on the growth and physiological health of red and brown seaweeds. The two are interested in the effects of UV and the interactions of UV and nitrogen nutrition on the growth, photosynthesis, and physiology of these seaweeds.

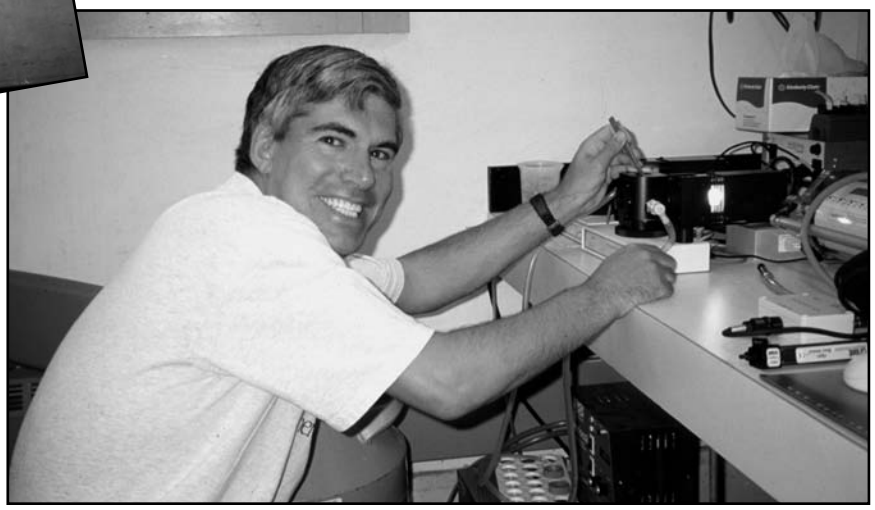
Physiologically, one of the ways that UV damages seaweeds is by creating free radicals (reactive oxygen) which hinder growth. However, seaweeds have a protective mechanism that produces enzymes that scavenge free radicals. With this protective mechanism in place, the algae should be able to thrive in nutrient rich waters, but may exhibit poor growth in nutrient (nitrogen) deficient waters.

With the help of summer interns Heather Stavros and Brian Kershaw, both undergraduates at Westfield State College, the researchers set up controlled experiments on the DMC pier. Red and brown algae grown in tanks with and without nitrogen were monitored for growth under films that screened various parts of the UV spectrum.

Using SCUBA, Ian, Carl and Brian monitored in situ sampling sites off Kresge Point to make parallels between the tank experiments and the real world. If UV radiation is hindering growth, there should be noticeable differences in growth rates between specimens living in shallow, subtidal and deep zones.

Back in the lab, the researchers used spectrophotometry, fluorometry and oxygen electrodes to get a better grip on what was happening physiologically. Using a liquid extract of the algae, they identified UV absorbing compounds and reactive oxygen scavenging enzymes, and assayed for changes in photosynthetic parameters.

Preliminary results suggest that Carl and Ian are on to something, and they are looking forward to returning to the DMC next summer to continue their investigations.



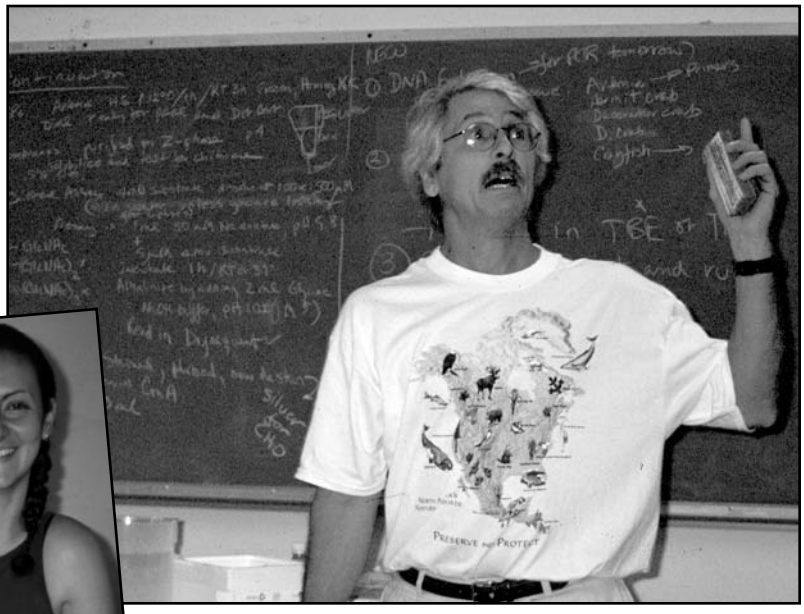
Top: Dr. Carl Grobe (center) and summer interns Heather Stavros and Brian Kershaw proudly show off their macroalgae/UV experiments on the DMC pier.

Above: Dr. Ian Davison prepares to dive on sampling sites at Kresge Point.

Right: Dr. Ian Davison runs samples through the spectrophotometer.

Molecular Approaches to Invertebrate Biology

Each summer, a variety of courses and workshops are offered at the DMC. Some are University of Maine accredited courses geared to undergraduate and graduate students, others are more specialized workshops developed to keep professionals abreast of the latest techniques in their field



Dr. Michael Horst

Diana Hernandez, M.S. student at Instituto de Ciencias del Mar y Limnologi, Mexico, and Beth Neves, Ph.D. student at the Universidad de Sao Paulo, Brazil.

Molecular Approaches to Invertebrate Biology has become a perennial favorite. Taught by Dr. Michael Horst, Professor of Biochemistry, School of Medicine, Mercer University, Macon, GA, this course has been offered at the DMC for the last five years.

Geared to graduate students, postdocs, professors and technicians the course addresses current molecular protocols and their application to the study of marine invertebrate taxonomy, form and function.

With participants from Slovenia, Brazil, Canada and Mexico not to mention, from every corner of the United States, this summer's group was one of the largest and most internationally diverse ever. Course alum Dr. Emma Creaser from Unity College, Unity Maine, assisted Dr. Horst with the teaching of some of the laboratory techniques.

Shea Tubberty, University of West Florida

New Courses for 2001

As this newsletter goes to press, we are in the process of establishing two new summer courses. Many of the details still need to be finalized, but here's what's brewin':

Dr. Eric Cole from St. Olaf's College in MN and Dr. Kevin Cook from Indiana University will present a two day **Fluorescence Workshop**. Laboratory exercises will include a lacZ expression system to visualize patterns of gene expression in early fly embryogenesis with bright field microscopy, and fluorescence microscopy of GFP-tagged gene products in the fly embryo.

Dr. Mary Jane Perry and colleagues will present a five week/five credit (UMaine accredited) **Optical Oceanography Course** for graduate-level students. The course will integrate measurements in the field and the lab, theory, and models to study underwater and remotely-sensed spectral light fields.

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Summer 2001

Undergraduate internships
REU • May 31-August 15
SURE • June 6-August 15
Applications available 12/00
Applications due 2/15/01

UMaine Accredited Courses
Shellfish Mariculture Techniques
May 21-25
Molecular Marine Biology
May 21-June 6
Marine Botany
May 28-June15
Optical Oceanography new!
July 15- Aug 17

DMC Workshops
Developmental Biology
June 20-23
Fluorescence Microscopy new!
June 25-27
Molecular Approaches to
Invertebrate Biology • July 2-7

Special Events
Alumni Day
July 21
Echinoderm Conference
August 22-26

Details on the web at http://server.dmc.maine.edu

Making Waves
Vol. 9, No. 2 • Winter '00-'01
Darling Marine Center
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