



UMass IGS Confers First Degrees

Yuko Hasegawa (UMass Lowell) and Christine Buzzell (UMass Dartmouth) completed their master's degree requirements in the fall semester, thus becoming the first "graduating class" of the University of Massachusetts Intercampus Graduate School of Marine Sciences and Technology (IGS).

"The faculties at UMass Lowell and UMass Dartmouth have launched the IGS into graduate education," says Brian Rothschild, Dean of the school. "Congratulations to them and to Yuko and Christine. We now have twenty-three students in marine sciences and technology. We're on our way."

The IGS was established just over two years ago as a system-wide school, making available to students the marine science expertise and resources of all the UMass campuses. Today, four campuses have IGS students, each pursuing marine research with a professor on a "home campus," and accessing marine sciences courses on the other campuses via distance-learning technology.

"Yuko came from the University of Wyoming," says her advisor, Professor Juliette Rooney-Varga, "with very little laboratory experience, and none in what we do in my lab [microbiology]. She did a great job in getting up to speed and learning the techniques. She was a pioneer at UMass Lowell, our first—and for her first year, our only—IGS student."

Yuko's research was a study of associations between marine bacteria and the

micro-organisms that cause the harmful blooms known as "red tide." Her work, says Rooney-Varga, shows promise to contribute to the fight to control what has become a worldwide economic and public health problem.

"Other students are now cultivating bacteria from Yuko's samples," Rooney-Varga says, "and we've found several that inhibit the growth of *Alexandrium* [the red-tide organism]."

So, could we one day "seed" the ocean with inhibiting bacterial cultures to stave off an imminent red tide bloom?

It's possible, says Rooney-Varga, but a more immediate likelihood is better prediction of blooms. Today's predictive models are weakest precisely

where the work of Yuko and her successors has potential to contribute: determining the growth and mortality rates of *Alexandrium*, which appear to depend in part on its bacterial companions.

"I was always interested in ecology," says Yuko, "but I did not know that microbes play such important ecological roles until I started working in Juliette's lab. If it is possible, I want to come back to school in the future and conduct research in this area."

While considering her future educational plans, Yuko is working at the Dana-Farber Cancer Institute in Boston—using those same biotechnology techniques that served her so well in Rooney-Varga's laboratory.

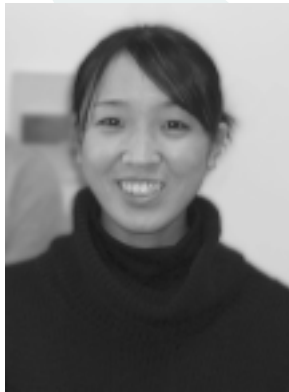
Christine Buzzell took advantage of the

IGS concept of distributed education, taking courses from UMass Boston, UMass Dartmouth, and the Naval Undersea Warfare Center (NUWC) in Newport, Rhode Island, which has a cooperative program with SMAST. Her two years of study were supported by an Office of Naval Research University Laboratory Initiative grant that combined both theoretical research at the University and experimental work at NUWC.

Christine's research, jointly supervised by Prof. Eugene Eberbach of UMassD and Christiane Duarte of NUWC, was in the area of autonomous underwater vehicles. Says Eberbach, whose own research formed the basis for Christine's work, "Her innovative research resulted in several joint publications, and could be easily extended to a Ph.D. dissertation. I've advised students from four continents, including national award winners, and Christine is one of the best."

Christine's thesis describes the design, implementation, and testing of a new programming language for underwater robotic vehicles. The language is intended to enable vehicles of different design and manufacture to talk to one another, cooperate and solve problems jointly.

Christine has parlayed her master's research into full-time employment at NUWC, where she is continuing the development of her "Command and Control Language." As for whether she'll return for her Ph.D., she is uncertain. "Who knows? Maybe in the future," she says, "but right now, it's good to be done." §



Yuko Hasegawa



Christine Buzzell

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University of Massachusetts
Intercampus Graduate School of Marine Sciences and Technology

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2004 Hurricane Season Breaks Records

The 2004 Atlantic hurricane season, which ended officially on November 30, was a memorable one for many. Six hurricanes struck the U.S., and a number of Caribbean islands were hard hit. More than 3000 deaths were attributed to the storms, most of them in Haiti as a result of Hurricane Jeanne's torrential rains. U.S. property damage is estimated at 42 billion (unadjusted) dollars, making 2004 the costliest hurricane season on record.

Lay observers were heard to wonder if there had ever been a hurricane season to equal 2004's. Was it an anomaly, or was it perhaps an early taste of extreme weather patterns caused by global climate change? And is society really any better prepared today for these violent storms than in the past? What is science learning about hurricanes, and how can this knowledge help us to cope with them?

To shed light on these issues, we turned to IGS faculty members Frank Colby and Stephen Frasier. Prof. Colby is a meteorologist and modeler in the Department of Environmental, Earth, and Atmospheric Sciences at UMass Lowell. In addition to his long-term collaboration with the National Weather Service on atmospheric model development, Colby's research focuses on boundary-layer meteorology and the seabreeze

circulation which dominates coastlines around the world. Prof. Frasier is an electrical engineer and Director of the Microwave Remote Sensing Laboratory (MIRSL) at UMass Amherst. His research interests include microwave imaging, radar and radiometer systems, and radio oceanography and meteorology.

A note of background: The standard weather pattern over the tropical Atlantic Ocean for May-November generates occasional tropical cyclones—large, counterclockwise-rotating air masses. Initially, such a cyclone is classified as a "disturbance," but if it increases in intensity, it may reach of the level of "tropical depression," then "tropical storm," and ultimately "hurricane."

UMM: Was the 2004 hurricane season the worst ever?

Colby: No, the 2004 season was active, but not the most active by any means. The

2003 season, for example, had 16 named storms, just as this season did.

UMM: Over the long run, are our hurricane predictions improving?

Colby: Data shows that hurricane forecast accuracy is really improving, just not improving as fast as everyone would like. The mere fact that the Tropical Prediction Center puts out five-day forecasts shows that the accuracy has increased. In 2000, the longest forecast lead time was only three days, and even the two-day forecast was considered "extended" and "subject to large errors."

UMM: Are we getting better at

helping us to predict coming seasons?

Colby: The hurricane tracks have patterns that have been used for many years as an aid in forecasting paths. Also, we seem to be emerging from a multi-decadal lull in hurricane frequency, with current conditions more similar to the 50s.

UMM: You've both mentioned the concept of "track." In August and September of last year, there were seven cyclones in the tropical Atlantic that reached sustained winds of 100 mph or more, yet deaths attributed to these respective storms range from zero to more than 2000. Damage figures show a similar pattern. So is the track of a hurricane, from a human standpoint, the crucial parameter? How are we doing with track?

Frasier: I think most folks would say we are doing pretty well in predicting hurricane track.

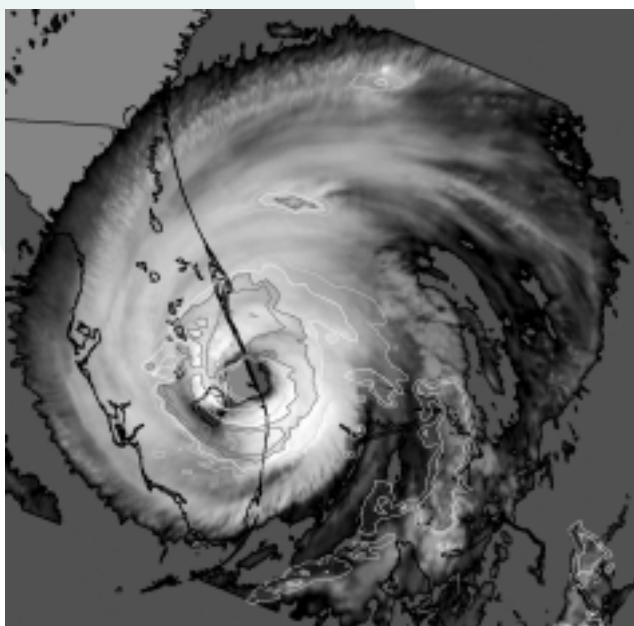
Intensity predictions are the bigger problem, in particular, identifying rapid intensification just prior to landfall.

Colby: The track accuracy is indeed getting better. Damage from a storm depends largely on the engineering and building codes for structures in the track, which has nothing to do with the forecasting. Deaths and injuries do depend upon our forecasting ability, but many of the deaths that occur in hurricanes are on islands which often have limited ability for evacuation, or even for good communication of the dangers. In addition, these islands often have steep terrain which makes the flooding from tropical rainfall even more dangerous. Even on the U.S. mainland, according to a study of hurricane deaths between 1970 and

1999, the fatalities are primarily from inland flooding—many of them as people try to escape from their vehicles in flood water.

UMM: What new physics has been learned about tropical cyclones, and does this knowledge help in predicting the formation and development of tropical storms and hurricanes?

Colby: A tremendous amount has been learned through careful observations, including radar and satellite imagery. We know that eyes, the centers of hurricanes, go through replacement cycles, and that the



Prof. Frank Colby

predicting which tropical disturbances will become depressions, which depressions will become storms, hurricanes, and so on?

Colby: The major difficulty with this part of the prediction is that we don't have good in-situ observations of systems until they are close enough to the U.S. to allow aircraft observations. This limits our ability to model the initial growth stages. We do know some of the controlling elements, like vertical wind shear, ocean thermal energy, etc.

Frasier: Yes, predicting the birth of a hurricane relies almost entirely on satellite observations and synoptic analyses: identifying the tropical waves leaving the African continent and determining where and when hurricanes are likely to develop. Once identified, the problem becomes a track and intensity forecasting problem.

UMM: What patterns can be seen by looking back at hurricane seasons over the past half-century or so, and how are they

strength of the winds is directly related to these cycles. We also know from recent lightning data that lightning frequency can reflect the hurricane's intensity trend.

UMM: *What role is new instrumentation playing in improving our ability to make observations?*

Colby: As the technology improves, satellites are providing progressively more information about storms. Our lightning detection network is also improving, and thus contributing to our ability to diagnose what a hurricane might be up to.

Frasier: Probably the biggest recent innovation is the use of microwave radiometers on board aircraft to measure surface winds and rain rate. The Stepped Frequency Microwave Radiometer (SFMR) developed at UMass and recently commercialized has been used for over ten years aboard NOAA's P-3 research aircraft in a research mode. Last year, this instrument was declared a "national need," which transitions it to a more operational role.

UMM: *So this SFMR will become a standard instrument for storm monitoring?*

Frasier: In fact, during this past hurricane season, NOAA's research aircraft were sent on several occasions by the National Hurricane Center to make "SFMR surface wind" flights. This was significant because these instruments have not yet been approved for the NOAA operational hurricane reconnaissance fleet of C-130s. Yet the measurements were deemed important enough to employ research aircraft to perform these operational measurements.

UMM: *How do these instruments work?*

Frasier: The radiometers measure natural (thermal) radiation from the sea surface at centimeter wavelengths. The SFMR responds primarily to the presence of foam on the sea surface, which makes the ocean appear radiometrically "warmer," and turns out to be a robust and accurate measure of surface wind speeds up to 70 meters per second [\sim 150 mph] or more.

UMM: *Have either of you been through a hurricane? Or flown through one?*

Frasier: I have to confess I've not flown in one ... yet. I expect I'd get pretty sick. Several of our students have flown. They assure me that it is really not so bad.

Colby: No, I haven't had the chance to fly through a hurricane, either. But even though I would figure on being airsick, I would love to have the chance. §

A message from the Dean . . .

Since our last issue two notable events have marked milestones for the UMass Intercampus Marine Graduate School.

As is told more fully in the accompanying story, Yuko Hasegawa (home campus: UMass Lowell) and Christine Buzzell (home campus: UMass Dartmouth) completed their degree requirements for Master of Science degrees in the fall semester, thus becoming the first students to graduate from the IGS.

Yuko's advisor called her a "pioneer," and Christine's advisor judged her "one of the best students I've ever supervised." But they're not atypical—exceptional students are the norm here. Yuko and Christine will surely be followed by a long, long line of successors.

In a separate development in November, the *London Times Higher*



Education Supplement published its highly regarded ranking of the world's best universities, and the University of Massachusetts found itself ranked in the top 50, among such distinguished company as Harvard, Oxford, MIT, Cambridge, and Yale.

It is doubtful that this remarkable achievement would be possible without the vision of leaders who saw that an integrated public university system, uniting the strengths of its various campuses, would best serve the citizens and students of the Commonwealth ... which just happens to be the model on which the IGS was founded.

I am confident that as we congratulate Christine and Yuko we can look forward to many more celebrations of the achievements and excellence of our students and faculty.

Brian J. Rothschild

Urban Harbors, continued from back cover

student in the work; in these cases, UHI helps support the graduate student's assistantship, while providing a real-world laboratory in the student's discipline. Since the institute has six to ten projects going on at any one time, there's a lot of potential for student involvement.

Does the urban harbor seem like a rather narrow specialty around which to build an entire institute? In fact, the urban harbor is more a focus for the institute than a limitation. In addition to undertaking projects particular to the urban harbor environment, UHI provides expertise in such areas as general coastal zone management, watershed planning, natural resource management, maritime industry strategic planning, water transportation, geographical information systems and renewable energy. What's more, UHI isn't bounded geographically. Although the bulk of its work is in Massachusetts and other Atlantic coast states, it routinely tackles national projects, and ventures as far afield as Puerto Rico, Russia, Africa and Australia.

A sampling of projects from the 2004-2005 docket gives a flavor of the diversity of work that the institute undertakes. The projects include:

- updating and revising the Gloucester (MA) Harbor Plan;
- a study of the emerging technologies and operational requirements of the international container trade;
- coordinating the Environmental Citizenship Academy at the UMass Boston;

- coordinating the annual Coastsweep coastal clean-up effort in Massachusetts;
- a study of best practices for translating science into management;
- a land protection plan for the undeveloped properties around the Weir River Estuary;
- a renewable energy feasibility study for the Boston Harbor Islands National Park area; and
- an evaluation of scientific issues relating to the design of Marine Protected Areas. §

Events

February 3-4, Washington, DC, National Council for Science and the Environment: Fifth National Conference on Science, Policy and the Environment: Forecasting Environmental Changes. See www.NCSEonline.org; contact Conference2005@NCSEonline.org.

March 13-15, Boston, MA, International Boston Seafood Show. See www.bostonseafood.com; contact Marlo Fogelman, mfogelman@marlomc.com, 617/375-9700.

March 24-26, Washington, DC, Second National Fisheries Management Conference: Managing Our Nation's Fisheries II: Past, Present, and Future. Details at www.managingfisheries.org; contact 707/923-7501. §

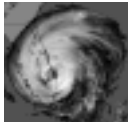


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Tracking Hurricanes

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Focus on ...

Urban Harbors Institute

Nearly two decades of Boston Harbor cleanup has produced a number of lasting results in addition to cleaner water. It created a treatment and outfall system that now serves as an international model for successful urban waste management. It led to a Boston Harbor Island National Park that showcases the cleanup's success. And, indirectly, it gave birth to the Urban Harbors Institute (UHI).

In its early days, the cleanup project was hampered by the scarcity and poor quality of available information in such key areas as water quality and pollution sources. In response, an institute was envisaged that would specialize in independent, objective research and information-gathering on Boston Harbor and other urban harbors, as well as provide training and education in related topics.

"The University of Massachusetts Boston was a logical home for such an institute," says UHI Interim Director Jack Wiggin, "with coastal and ocean scientists and policy specialists already conducting research on the environmental health and economic importance of the harbor."

Established in 1989, the Urban Harbors Institute now employs five full-time professionals, but its potential staff is enormous, including faculty from UMass Boston departments such as Environmental, Earth and Ocean Sciences, Biology, Economics, and

Management, as well as from other academic institutions, both within and beyond the UMass System. The institute also engages senior professionals from outside academia in some of its projects. The nature of the work determines who is recruited to participate.

As Wiggin puts it, "We fit the people to the project."

Students constitute another important talent pool for the institute, and insuring their involvement is "one of the things that we've done best," according to Wiggin. At any given time, UHI usually employs two graduate students and one or more undergraduate students, assigned to projects by the professional staff. In addition, a professor recruited for an institute project will often involve a graduate

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