Personal Statement:
My vision, mission and goals working at UMass Boston and EEOS




Photos by A. Frankic, from left: Wellfleet harbor; horseshoe crab *(Limulus polyphemus)*; PO boat, Boston Harbor; fish weir construction on Thompson Island (Boston Harbor);

"The shore is an ancient world, for as long as there has been an earth and sea there has been this place of the meeting of land and water.... Each time that I enter it, I gain some new awareness of its beauty and its deeper meanings, sensing that intricate fabric of life by which one creature is linked with another, and each with its surroundings." Rachel Carson

Introduction

UMass Boston is a coastal campus, nestled in Dorchester Bay, Boston Harbor. From the vantage point of the upper floors of the Healey library, we look out to Spectacle Island, rebuilt from refuse from the Big Dig, to Deer Island hosting the city's water treatment plant, and far in the distance, to Boston Harbor Lighthouse. From Fox Point, in front of the JFK Library, we can watch the cormorants standing on the floating docks, drying their oil-less wings. Local fishermen and women catch bluefish and striped bass off the Harborwalk. As a campus we live in the arms of the harbor, surrounded by salt water and islands, sheltered from the worst ocean storms. This is the most important lesson we can teach our students: This harbor is our home.

For some, this is a new idea. My oceanography students, for example, are often surprised to learn that, from the windows of the campus shuttle buses, they can watch the tides across Savin Hill cove shift daily one hour forward, following the pull of the moon. Other students bring a sense of the coast as home with a longstanding passion, envisioning salt marshes, eel grasses, oyster beds and green roofs as part of their vision for a new campus master plan. All of us have learned from the history of this region's Native American community, who summered on Thompson Island at the confluence of the Harbor's three main rivers: the Neponset; the Mystic; and the Charles.

As a coastal campus, we face the same difficulties as do most of the world's coastal communities, including a history of poor water quality from development and sewage disposal, loss of habitats and species, as well as threats from the projected impacts of climate change, most notably sea level rise and increasing storm surges. UMass Boston has the opportunity to play a leadership role in addressing these and other coastal concerns. The EEOS department in particular "integrates the natural and social sciences to generate and apply new knowledge about the quality of our environment and the sustainable use of its resources. It focuses on promoting integrated science, planning, policy, and education for understanding earth-system processes and

managing complex interactions between human activities and natural processes in linked watershed and coastal marine systems."

The challenge to my work over the last five years has been to research and implement ways to enact these university and departmental visions in order to steward this harbor and our coastal areas most effectively:

My vision, mission and goals in my work are based on the integration of three key areas – teaching, service and scholarship - in order to best practice coastal ecosystem stewardship for this campus, this harbor, and for coastal areas around the globe.

My central premise is that the "environment sets the limits" – and therefore we need to learn and practice living within the requirements of the ecosystems that sustain us.

My practice of stewardship, still evolving, is rooted in my experiences working as an ecologist at the Croatian National Park Plitvice Lakes in the late eighties until the war started in April 1991. It became clear to me there that natural science alone would not be sufficient to solve a number of this Park's issues, such as the lakes' eutrophication, mortality of the noble crayfish (*Astacus astacus*), meadows ecosystem degradation and forest succession, but instead a more holistic process was required that needed to include both the involvement of local communities and the integration of sciences and technologies.

Plitvice Lakes are part of a karst watershed where 16 lakes are connected with travertine barriers, creating a unique and pristine fresh water ecosystem often compared to the marine coral reefs. Through the graduate program in limnology I studied the transport of macrobenthic biomass through all 16 lakes, in order to improve the understanding of the causes and effects of eutrophication. During my five years working as an ecologist in the Park I learned about the protected areas management's misconceptions of natural ecosystems and the resulting mismanagement of the same, with minimum or no connection between the local community, scientific research and the decision making processes in the Park. It was disturbing to see how human activities were slowly but surely degrading one of the UNESCO's World Natural Heritage Sites.

I began to expand my role as an ecologist to include educating local communities, tourists and nationally responsible organizations about untreated sewage and solid waste discharges into the lakes system, as well as the dredging of the tributaries, illegal fishing and hunting. During my free time I gave presentations and special guided tours of the Park, in particular to bring these issues to the attention of the national and international authorities responsible for the Park. Where else can we practice conservation and protection of the environment if not in the protected areas? It was out of the desire to answer this basic question that I knew I needed to not simply be a natural scientist, but instead learn to incorporate more social science and community knowledge into my work in order to better understand and protect natural areas and the communities that rely on them.

Almost as a painful paradox, the war in ex-Yugoslavia broke out in this National Park on April 1, 1991. My family and I became the first refugees; in 1993, I accepted a two year USAID

fellowship for the doctoral program in marine science at Virginia Institute of Marine Science, Williamsburg, USA. My conviction of the necessity for stewardship between people and nature grew out of this experience of both environmental and social disruption; I began to understand and value stewardship as a basis for peace and safety.

Most of my career and work relates to the coastal environments, but here at UMass Boston is where I have been developing and applying this concept of stewardship in my teaching, in my service, and in my scholarship. Stewardship is not focused on basic scientific research, though it may include that, but instead draws more heavily on the best available existing science and technology, including local and traditional knowledge, to serve the needs of a given place.

There is no simple recipe for doing this. It is a long term process that evolves over time, as we come to learn both the ecological and human communities belonging to a particular place. It requires that we come not simply as researchers, managers or outsiders, but be willing to make a commitment to belong to the place ourselves. For example, this slow process unfolded with the Mather School, a local elementary school overlooking Dorchester Bay. Over the course of four years my work with the school grew from picking up trash in their yard, to founding Boston Shines, a city-wide beautification day, to the establishment of an outdoor classroom in the Mather School schoolyard.

What might it mean more generally that "*the environment sets the limits*" here in Boston Harbor? What would it entail for us to live here self-sustainably? Over the last three years, I established the Green Boston Harbor Project (GBH) as a research vehicle for exploring these questions. The project takes a holistic approach to coastal stewardship, including taking water and sediment samples, monitoring for invasive marine species in the harbor, gathering historical data on harbor ecosystems, participating in community-building activities such as beach cleanups and outreach festivals, or initiating aquaculture and stock enhancement of native oysters and blue mussels to improve water quality and health of the harbor.

My students learn how to use existing knowledge, how to work on local problems where they live, and how solutions they find could be translated to other areas, so we might become an example for other coastal areas seeking to solve their own ecological and socio-economic issues, and to live within their own ecosystem's limits.

Practicing stewardship in this way requires us as managers to become fluent in a variety of community cultures and ways of sharing information. Thus, although some of my work has been published or is currently in review in traditional peer-reviewed scientific journals, in order to reach the widest audience I have also created a GBH website, provided interviews for magazines, videos, and documentaries such as 'Bag it' presented at the Museum of Science, and one on the green economy for the National Council for Environmental Sciences conference. In general, I strive to make my work as accessible as possible.

Funding for my research has grown organically over time. GBH now has an MOU with the City of Boston for research, education and outreach in the Harbor, the New England EPA has recently chosen UMass Boston as their collaborative partner for the Urban Waters/Mystic River

Watershed Initiative, and local and state organizations are "adopting" our students through the "Adopt a student for a green job" program I established in October 2008.

The mission of the GBH project is to bring science, technology and communities together to solve ecological problems. Our work has underscored that this process takes time, both to accomplish and to measure, as well as a commitment to stay rooted in a particular place. UMass Boston's own long term commitment to its surrounding communities makes it an ideal place to demonstrate this practice.

What follows is an overview of my work today, with a central focus on the GBH project, both past work and my vision for its future. Although this statement is divided into separate descriptions of teaching, service and scholarship, in the practice of my work these are linked together. The attached Service and GBH Overview Tables (3-4) provide a timeline of my work, and a visual representation of some of these linkages.

Teaching and Advising

Teaching

My fundamental goal for my teaching at EEOS is to develop a successful engagement and connection between students, the coastal environments, and coastal communities, one based on the premise that *"the environment sets the limits"* for human interactions with coastal ecosystems. This means that the functions and resiliencies of ecosystems underlie human social and economic activities, not the other way around, as has often been assumed to the detriment of both human and other living systems.

I am filling a relatively unoccupied niche in the EEOS department and in UMass Boston at large that encompasses my research, educational and outreach efforts to better understand the relationships among humans and the rest of life around us, and thus to rationalize our practice of stewardship in concrete scientific and community knowledge. With applied environmental research, education and outreach enmeshed together through stewardship I expect to substantially contribute to increasing those efforts.

"I am teaching students how to use existing scientific and community knowledge, how to work on local problems where they live, and how those solutions can then be translated to other areas."

My practice includes the 'triple bottom line' approach, biomimicry, and ecoliteracy methodologies as these are essential in the education of this and future generations. This practice requires 'a village' to build it, thus my work includes forming alliances with my colleagues and friends within my local community as well as internationally. Every semester brings dozens of diverse students to my classes. Teaching them the subject matter isn't always enough to bring them success. They need to see the complexity of the issues in the world outside the classroom, the strengths and challenges of the local environment, and at the same time learn about solutions and success stories for addressing those challenges. In addition, taking students into the field and on the harbor helps tremendously in teaching by allowing them to directly experience the nature around them. If the students were never on a

marine research boat, on the water taking plankton samples, or being in contact with different intertidal native and invasive species, they will never know if that might be their call.

Since 2006, I have been teaching undergraduate students in Intro to Oceanography each spring (6 semesters, 270 students) and Coastal Zone Management in the fall (5 semester, 141 students). I also developed a graduate core course at EEOS, Coastal Ecosystem Management (13 graduate students), and the Green Boston Harbor class and projects (20 students). I will be teaching an honors class in fall 2011 and Intro to Biomimicry course in summer 2011 (Please see Appendix 1: Teaching Summary Table).

My pedagogy has evolved over the course of this time. My previous teaching experience was mainly abroad. This student community at UMass Boston is so diverse that it is critical to maintain daily communication and work with students, listen to them, and take their constructive criticisms seriously. In order to improve my teaching, I also have taken the CIT seminar (semester long training at the Center for Improvement of Teaching), STEM workshops in Boston area, a Biomimicry educators' training workshop, and reviewed current pedagogical literature. In the past five years, I learned that it is important to practice and test innovative teaching methods in support of holistic science education, allowing student to use arts, poetry and video in their assignments.

I was initially surprised by the lack of general knowledge many students had, especially about the oceans and the environment. This was particularly true in my first teaching course, Introduction to Oceanography, a General Education requirement course that brought together freshmen and seniors, a variety of majors, and a wide range of prior experience with environmental issues. In order to reach as many students as possible, I experimented with different pedagogical methodologies each year, including adding group work, more homework and project assignments, as well as learning through games and going into the field. My methods seemed most rewarding and successful in the coastal management class where all the students were EEOS majors with only few exceptions, and the course enrolment increased from 15 to 50 students per class.

After two semesters of teaching I developed an initial first-day survey; from the results of this survey I adjusted the syllabus to better meet student goals, objectives and expectations from the class. In Spring 2008 I changed the structure and teaching methodology for the Intro class by using 'living in the ocean' as a theme for linking the other four aspects of oceanography: biological, physical, chemical, and geological. My graduate TAs and I developed a fisheries simulation game and an 'ocean-speed dating' game. This did elicit more student excitement, but still not the level of teaching success I was expecting.

My most recent teaching of Intro to Oceanography was in Spring 2010. The syllabus was based on the classic structure of the four areas but linked throughout with the living aspects in the ocean including different species' evolutionary adaptations based on their surrounding physical conditions. In addition, I created a much stronger and more compact teaching structure, using many visual examples from real life (short videos and documentaries). I also demanded more from the students: they had assignments to work on once a week, in addition to their midterm

and final exams. Although I often practice group work in my class, this last semester it was challenging to do so with 55 students placed in a room for 40.

Over the last five years, I kept records of my students' mid-term course evaluations as well as the formal university ones. Through this process, I was able to make evidence-based changes in my teaching methods, and have now developed a good teaching portfolio for a Gen-Ed course like the Intro to Oceanography. The remaining underlying difficulty with the course is likely structural with its mix of Gen-Ed students and EEOS majors (often 50:50). This spring the department will implement my longstanding request to separate the class for EEOS majors and non-majors. The latter will be offered every second summer.

The CZM classes have worked more successfully from the beginning. The mission I offer to my students is to learn about the area where they live by choosing an environmental topic that will both contribute to their learning process and allow them to apply their knowledge and stewardship in specific area. My Special Topics class on the Green Boston Harbor gave students an opportunity to apply this understanding to their current "home" – UMass Boston – through active participation in the Master Plan planning process. The students envisioned their Campus with salt marshes, eelgrasses, green roofs and oyster reefs as part of our coastal community and outdoor classrooms, and participated in the Master Plan subcommittees.

Is there a recipe for the best teaching? Yes and no – each student is unique and every class is unique. Listening and communicating with students helps me prepare the best class and teaching for each particular constellation of students and learning styles. In addition, I make sure that there are opportunities for engaging my graduate students with the undergraduates in the classroom and in the field – it is a very important practice with amazing results when students can teach and learn from each other.

Advising

After five years at UMass Boston and EEOS, three of my graduate students have finished their masters programs. Their projects addressed local environmental issues in the areas where they lived, helping them and the local community to better understand environmental issues, as well as provide solutions and best management scenarios. For example, clam and oyster shellfishing and aquaculture in the Wellfleet Harbor has been continuously in decline. Annie Cataldo, herself from that area, helped to define and select suitable sites for cam and oyster sanctuaries. She also identified knowledge gaps to be addressed by future research. Presently, this project has been helpful in the first oyster reef restoration site selection and implementation in Wellfleet Harbor by the Mass Audubon and The Nature Conservancy.

Another masters project was done on Martha's Vineyard Island, where Shelley Edmundson developed a protocol for the identification of suitable offshore sea scallop aquaculture areas; she identified these sites based on the available scientific knowledge and georeferenced data. Shelley recently received the Vineyard's Vision Scholarship for the next four years to continue her education at the University of New Hampshire, doctoral program in Zoology. The third project was done on Nantucket Island by Kim Starbuck. Her research assessed and recommended the best management practices to save the bay scallop population and traditional shellfishing activity on the island. All the projects have been presented at national and international conferences and

the manuscripts are in review or in press in peer reviewed journals. All papers are available on the GBH web site as well as in the scholarship binder #3.

Presently, I have four doctoral students and three master students. Please see Appendix 2: Graduate Students list, with a summary of their topics and accomplishments.

Doctoral students:

1) Lisa Greber, a 4th year student, has worked on coastal stewardship issues, both on Cape Cod and in Malibu Bay (Boston Harbor). At the Waquoit Bay National Estuarine Research Reserve on Cape Cod she did outreach, education, and research on climate change and other environmental issues with local religious communities. The project is funded by one of five NOAA/NERRS Social Science Fellowships awarded in 2006; NOAA is interested in learning how social science research can complement and enrich their natural science research program. From this research, she developed a holistic science approach she then applied to an initial ecological and social assessment of Malibu Bay (please see submitted papers in review for publication). Her work was recently recognized by the NOAA Walter B. Jones Award for Excellence in Coastal and Marine Graduate Study. She is planning further work exploring how this approach could best be used to support ecological restoration by helping communities connect better with nature.

2) Seth Sheldon, a 3rd year student, works at the nexus between water use and energy production, studying these linkages at both the national and state levels. He has been "adopted for a green job" (see description, below) by the Civil Society Initiative, where his work will contribute to the water-energy nexus project. (Please see our paper submitted to Solutions, in review).

3) Erin Rempala, an incoming student, plans to focus her research on the potential synergies between salt marsh and eelgrass restoration, exploring whether coupled multi-ecosystem restoration projects prove more successful than single system ones. She will be presenting at the NEERA and RAE this fall.

4) I am also a major advisor and mentor to the doctoral student from Croatia, Ms. Zvjezdana Popovic, at the University of Split, this is her 3rd year, and her accepted project proposal is "Biology and population dynamics of *Venus verrucosa* in the East Adriatic Coast".

Masters students:

1) Chris McIntyre is a second year master student, working on invasive species monitoring in Boston Harbor. He has been "adopted" by the City of Boston to work on the PO boat and GBH project to assess the requirements and needs of the Boston Harbor as a No Discharge Area. He recently received a MA CZM invasive species internship, which includes participation in the International Invasive species rapid assessment training program. His work was essential in preparing the reports on the invasive species and PO boat activity (www.gbh.umb.edu)

2) Taylor Brown entered the program in spring 2010. He has been "adopted" by the Provincetown Center for Coastal Studies, with a project focused on Cape Cod shallow water habitat assessment and mapping.

3) Vanessa Yandell is a first year part time master student, working in the area of coastal pollution and human health issues.

My advising included close work with Prassede Vella (EEOS, 2005), a doctoral student working on the marine protected areas (MPAs) in Malta. I organized our trip to Murcia, Spain in 2007 where we presented two papers at the European MPAs Symposium. She is presently working for the MA Executive Office of Environmental Affairs as an Ocean Management Analyst. I also worked on the committee of a master student Erin Remillard who graduated in 2008.

Since 2006 I have been a committee member of a doctoral student Reinmar Seidler (Biology Department) and Kim Frasure (EEOS). Reinmar defended his dissertation in May 2010, titled "Natural forest management and conservation of biodiversity in tropical forests." Kim passed the comprehensive exam and her project proposal has been accepted, with the title: "Integrating management tools for connecting humans with ecosystem health in urban estuaries."

I have also maintained graduate level academic ties in Croatia. I contributed to the development and establishment of three graduate programs in Croatia: the Graduate Environmental Management program at the University of Dubrovnik; the International Doctoral Joint Study in Environmental Science which includes five universities: University of Split in Croatia, University of Molise in Italy, University of Hamburg in Germany, University of Targoviste in Romania and University of Alicante in Spain. I am also an adjunct professor at the IZOR's Postgraduate Degree Programme: Applied Marine Sciences, at the University of Split. I assisted in the development of this graduate program and developed a course, Integrated Coastal Area Management.

In the past five years, it has been my pride and joy to mentor and advise undergraduate students in their educational goals, research projects and community participation. I would specifically mention here Alyson Pitts, Bonnie Fryer, Meredith Eustis, Patty Slattery, Alex Etkind, Tricia Teehan, Dorothy Bassett, Anna Hines, Jacquelyn Spade, Sandra Vasquez, Mike Morrissey, Katharine Goodrow, Julie Teibel, Gabriela Antunes, who all worked with me on their independent study projects with passion and dedication. Some of them successfully presented their work at conferences and workshops. All of them contributed to their local communities by addressing their environmental issues (please see the GBH web site for graduate and undergraduate students' projects, www.gbh.umb.edu)

Most of my undergraduate students work one or two jobs in order to sustain their existence and academic achievements. This is an impediment that prevents most of the UMass Boston students from graduating within four years. The "Adopt a Student for a Green Job" program I created addresses this important issue. Local organizations can "adopt" a student, supporting part or all of their educational expenses. The organizations gain dedicated environmental employees, while students gain valuable experience working in their chosen field for the benefit of their communities. In the last few years, 10 undergraduate and 5 graduate students have been

"adopted" thus far. Some of them have been offered fulltime jobs at the same agency following graduation. (For brochures please refer to Binder 3, Scholarship, in 'other publications'). This is an excellent example where I connected teaching with service and scholarship.

Teaching towards service

In my field of coastal ecosystem management I realized that I too need help from the community to be able to engage my students in field studies and environmental solutions. I am humbled and appreciative every time an environmental agency, business or consulting firm takes on another student of mine. It is important that we acknowledge that it takes a whole community to contribute to and be responsible for educating our students.

In return, I am teaching our students how to become part of coastal stewardship, to take ownership and appreciation of their environment, and to become responsible and respectful human beings. It doesn't matter if they will become environmental scientists and academics or teachers, business managers or field workers; what matters is that they become part of our society and make a difference for the better today and tomorrow in our troubled and hurting environment. We have an obligation and responsibility to give an opportunity to every student to learn about their environment, about the oceans and coastal ecosystems.

How do I help students engage with the material? By sharing my own passion for stewardship with my students, as well as my unconditional dedication to them as individuals. Most importantly, I try to bring my students hope and enthusiasm in addressing environmental problems. I believe that every environmental issue has a solution. I strive to teach students to become independent thinkers, to follow their own questions and research in order to advance their knowledge and direct them towards the best possible solutions. One of the prerequisites towards solutions is to first ask 'how am I,' and 'how are we,' not just 'how are they' – this premise allows us to take ownership of our surroundings, to become responsible and accountable as scientists and as citizens.

Service

Community

How do we become accountable? Living in the Dorchester area I first took ownership myself of my environment, both the human and the non-human natural ones. My neighborhood is surrounded by drugs, prostitution, crime, and violence that we know can be prevented and turned around as can any other environmental issue. It has been proven that a healthy environment leads to a healthy society and to a healthy economy, as well as to reduced violence (e.g. Focusing Resources on Effective School Health, FRESH/UNESCO's Framework).

"How can we connect to a sense of place when many of us like me come from different countries? There is no recipe for that; we learn by doing it.

Find where the gaps in our knowledge are, engage other people, and each person contributes in a different way.

It's a living dynamic process - if each of us is not part of the ecosystem, the ecosystem doesn't really have a chance to recover or function in the long run."

I initiated a collaboration working with the Mather Elementary School and the Meetinghouse Hill Community specifically in addressing the

neighborhood crime issues by beautifying the environment we live in. As a member of the Mather's School Site Council I am working with K-5 students and teachers in beautifying the school yard and improve environmental education in the classrooms and outside in the field. This is possible with help of my undergraduate and graduate students and their independent studies course where they work with the teachers and contribute in the classrooms with environmental science teaching. In the last three years I also organized each spring the Boston Shines, a community clean-up where parts of the neighborhoods were cleaned and beautified for the first time in more than twenty years. As a result of all this work we (as the community) received a schoolyard outdoor classroom grant of $300,000 provided by the City of Boston. It took four years to get to this opportunity and it took additional year to plan the outdoor classroom and last summer the construction started and will be done some time in October 2010 (Please see Appendix 3: Service Overview Table).

University, CSM, EEOS

The University is also our community. I have been working closely with the Office of Government Relations and Public Affairs, bringing environmental education to our local community, including developing summer programs for local highs school "green teams" (e.g. Neponset river neighborhoods) and establishing 'Youth for Environmental Stewardship (YES) in the Mystic river neighborhoods ('join the YES gang not the street gang').

My service to the University as a whole includes membership in the Faculty Council on Academic Affairs, the Landscape and Architectural Subcommittee for the Campus Master Plan and Fulbright Fellowship Committee.

As a member of the Students Success Task Force at the College of Science and Mathematics, I brought together my commitment to education with my coastal focus; I addressed issues such as taking students out on the Boston Harbor, especially for orienting incoming students, as well as the longer term need for establishing outdoor classrooms and living labs. My efforts resulted in the creation of a $50,000 fund that will support classes to take students on boat field trip to Boston Harbor. In addition, students will be able to learn how to build a green roof on the Science building, and to establish a restoration sites for the salt marsh, eel grass and shellfish habitats.

Within the EEOS Department, I have worked on faculty hiring committees, graduate admission committee, and undergraduate advising. I also organized the EEOS Seminar Series from Spring 2007- Spring 2008, and served as the advisor to the departmental graduate student association, the EEOS Association, for the last three years. I intend to continue in that advisory role in the coming year.

Professional

I participate in a number of state, federal and international committees, boards and programs (see Service Overview Table 3). For example, I helped draft and finalize the MA Ocean Plan, through my participation in the Science Advisory Council. In doing so I also engaged my students to provide their public comments as part of their final exam for that year's Intro to Oceanography class. I have been working with the UN Global Forum for Oceans, Coasts and Islands since its establishment in 2001, including addressing global aquaculture, fisheries and coastal community

and stakeholders' participation issues. In addition, my ongoing work with the European Aquaculture Society on the EU's sustainable aquaculture development and practices made my sustainable '*polyculture*' methodology and '*environment sets the limits*' approach as potential solutions for the future of this industry in Europe.

Scholarship

As described in the previous sections, my scholarship grows from my expertise in international coastal management, using an interdisciplinary approach that includes the natural sciences, social sciences, and community-based knowledge and input in order to solve long-term, systemic ecological problems. My scholarship is applied – the scholarship of praxis. During my first few years at UMass Boston, I continued to emphasize my international work. As I came to know both the university and surrounding communities better, I developed the Green Boston Harbor project applying insights from both international and local perspectives.

International

Most of my international projects and coastal management efforts are focused in the Adriatic region, especially in Croatia. My efforts in natural and cultural protection and sustainable development, including in the national park where I worked and lived, have brought more that 25 million dollars of international grant funds to the region. These efforts have also earned me the position of Special Advisor to the Croatian Government for natural, marine and coastal areas.

I have been initiating new research and conservation projects in the Adriatic coastal areas and applying them to the Global Environmental Facility (GEF) funding program. I am sharing this experience and learning process with my students, and hope to develop a project that will help in funding our students to work here and abroad. For example, the most recent project I initiated and worked on is the Nature Protection Investment Program for Croatia and the Adriatic region that is funded through the World Bank.

In the summer of 2007 I was invited by the Government of Tanzania, and the Zanzibar Revolutionary Government, to help in the implementation of the Marine and Coastal Environment Management Project (MACEMP). This is a regional project in West Africa funded by the World Bank with $62 million over six years; my volunteer work took place during the project's second year. While in Zanzibar I assisted in the development of the Terms of References for identified research projects and coastal management activities, including the education of local communities about sustainable fishing gear, as well as the importance of coral reefs and maintaining their biodiversity. I also prepared a draft plan for the integrated coastal zone management of Zanzibar that includes existing and potential marine proteced areas.

Collaboration is crucial for success in protecting coastal areas. My international ties were extremely useful to the project, aiding collaborative efforts to link existing environmental projects in Zanzibar led by different international agencies. I was invited to visit the first private marine protected area in the world – Chumbee Island. I identified critical issues to be addressed in order to have a successful project implementation, including the importance of linking the tourism industry, hotels, and private diving companies. Finally, I spearheaded the idea to involve Imams of the local religious communities in order to support environmental awareness in

Zanzibar as well as Tanzania (Please see the reports in the Scholarship binder that were submitted to the MACEMP Director and the Governement of Tanzania).

My future international work will reflect the lessons learned here in Boston Harbor (see below) about listening to the local ecosystems and the communities they sustain. Recently I visited the Institute of Coastal Studies in Braganca, Brazil (affiliated with the Federal University of Para) to discuss potential collaborations. The Institute's mission of coastal stewardship closely parallel's EEOS's own. Potential collaborations are likely to include exchanges of faculty and graduate students, working on coastal ecosystem and habitat assessments, as well as coastal habitat restoration (please see the report in the scholarship section).

The Green Boston Harbor (GBH) Project

This project marks a transition point in my work, as it integrates all three aspects (scholarship, teaching, service) in a central focus of the coastal stewardship. Please see Appendix 4: GBH Project Overview Table, for details.

My scholarship has grown naturally from these community connections. I have found my niche in the larger community as well as at UMass Boston in making stewardship between coastal natural systems and humans possible. In 2008, the Mayor's office asked me to support the recently declared No Discharge Area (NDA) in Boston Harbor. This initial focus on a specific aspect of water quality grew into the broader vision I developed for the Green Boston Harbor (GBH) Project. The health of the harbor's water is fundamentally linked to the health of its ecological and human communities. The primary goal of the GBH project is to integrate components of education, research and outreach in support of the NDA and this broader vision of harbor health. In addition, the designation of the NDA also provides an ideal opportunity to develop guidelines for the first "Green Harbor" in the USA.

"GBH strives to bring issues together - so that people can understand that green roofs in Boston are related to water quality in the harbor, and that shellfish, eelgrass and salt marshes established together are healthier than any single ecosystem alone."

This designation and our preliminary studies have made it exceedingly clear that there is a need for more comprehensive assessment and analysis of the local environmental, social and economic conditions. GBH provides an outstanding opportunity for EEOS undergraduate and graduate students to develop their individual activities, theses and dissertation topics in ways that integrate educational, research and outreach components through a holistic science practice. This includes gathering physical, chemical, and biological aspects of the harbor; using a holistic process (all the ways of knowing) and including all communities – are all affected communities involved in researching and stewarding the harbor?

One of the early results of the project is a detailed assessment and GIS analysis of the Boston Harbor (BH) recreational and commercial boating and pump out (P/O) activities. The assessment measures the adequacy and potential gaps in existing and planned P/O coverage and capacity in the BH area; public awareness and knowledge about the importance of P/O, and the role of these activities in the potential improvement of coastal water quality and biodiversity in the Boston Harbor. In the longer term, the project seeks to determine the impacts of waste

discharges from boats not engaging in P/O activities. To document this last, the project will provide information on ongoing environmental monitoring and assessments of water and benthic quality, as well as fish and shellfish species, to help track changes and trends in biodiversity in the coastal waters of the BH.

BH has not had a comprehensive biodiversity assessment of what used to be here as well as what biodiversity we have now. Such an assessment is necessary in order to have a vision and plan for the future of the BH. The GBH is addressing this gap by engaging students and working with professionals in this field to assess not simply coastal habitats but also biodiversity status and trends.

GBH has been conducting seasonal surveys of commercial boaters while they engaged in pump out boat activity. Based on these survey results, as well as a comprehensive environmental and socio-economic assessment of the BH area, the project will provide recommendations for best management practices concerning three key areas: 1) improvements in the availability and use of P/O services; 2) monitoring, evaluation and enforcement of the NDA in BH; and 3) establishment of guidelines for a sustainable Green Boston Harbor. (Please see 2009 Pump-out Boat Service, Research, Education and Outreach Report for details.)

While the P/O boat activities reaches one critical BH community, the health of the harbor is also dependent on activities further inland. Thus, GBH seeks to address environmental issues and communities within the Mystic, Charles and Neponset rivers watersheds. We are pleased that through my initiative and the support of GBH, UMass Boston has been selected for the EPA New England Urban Waters/Mystic River University Collaborative.

Teaching youth ecoliteracy and how to be a steward with their environment is a crucial part of their educational and professional development. Therefore GBH has been working with schools and community organizations in the Neponset and Mystic river watersheds. This summer I helped develop an environmental project for the Youth Green Team at the Hyde Park CDC (Community Development Corporation). The project included a canoe trip on the Neponset River for water sampling, and a follow-up day at the microbiology lab at the Mass Bay Community College to learn how to do basic water quality testing on our river water samples. From their trip and analysis, the Green Team concluded that the Neponset would need a lot of help to heal. To support the river, they wrote a letter to their city councilor and state representative stating their findings and their recommendations for improving the river's health.

Malibu Beach and its corresponding Savin Hill bay is also one of the key sites for involving local communities in GBH work. The beach, a short walk from the UMass Boston campus, is heavily used by local residents, including casual visitors, dog walkers, fishermen and women, and members of the local yacht club. However, few will swim; the bottom is an unpleasant sticky black mud, likely the result of pollution and hydrological changes in the bay following eel grass removal during initial beach development.

The GBH Malibu Beach project, started in the summer of 2009, explores the feasibility of expanding the on-shore salt marsh as well as the longer term possibility of restoring eelgrass for bay bottom stabilization and potential native oyster, mussel and soft shell clams colonization.

The environmental assessments include an intertidal biodiversity survey, transect studies of existing salt marsh, monitoring of invasive species and water quality (particularly at the yacht club docks). We also plan to perform side scan sonar analysis of the bay bottom as well as an analysis of sediment.

The support and participation of the various Malibu communities is as important to the success of any potential restoration project as is the natural science data. One of the first steps of the project was a survey of day users to discover their reasons for visiting the beach, their knowledge of some of its ecology and environmental conditions, and their vision for its future. In addition, yacht club members and others interested were invited to join researchers as they monitor invasive species or take water samples (For details please see "Listening to the grass: Towards a holistic science approach for restoring human and natural systems in Malibu Bay" in the publications section.)

The Malibu Beach project is important in its own right, but also serves as a microcosm for many of the activities of the GBH project by integrating natural and social science data and involving local communities for better stewardship of the BH thus demonstrating a new way of teaching, learning and doing management in coastal environments that can be applied in future GBH projects.

Future Goals: Towards a Biomimetic Boston Harbor and beyond

As we are facing the environmental challenges of the present and the future, education is the base for encouraging people to live more harmoniously with their local ecosystems. However, present passive education and knowledge has to become an active living knowledge that will apply a stewardship approach in everyday practices now and here. My goal is to prepare students for green jobs, as any job can become green if we do it within the limits of our natural surroundings. My job is also to prepare students for green citizenship, within both the human and ecological communities where they reside.

I have learned there is no recipe, but we can share our stories and efforts around the world with others trying to steward their own coastal areas. The process is similar: who are the players in the local natural and human communities? What data do we have? What is missing? Could I find that missing information within indigenous or other local communities who already belong to that place?

How do we communicate and share? Healing will not be successful if we don't include everybody!

As a steward and not a scientist, my research, teaching, and service grows from the natural and human communities around me. I address problems here and now in the real world. To be successful in this work our understanding of the environment has to be based on knowledge of the whole system (e.g. Boston Harbor and its watersheds), not just of its individual parts (e.g. invasive species; blue mussels; eelgrass, water quality). We need to know how the system works, what is missing, what is damaged, and how can we help? I strive to facilitate more students and

community members to become stewards, to understand what nature is and how we can become part of that nature.

One of the most important parts of my future work at UMass Boston will be to establish an outdoor living lab where we can learn how to restore salt marsh, eel grass and shellfish beds together. Major goals of such a complex project include minimizing erosion, mitigating degraded coastal ecosystems in BH, developing a protocol for biomimicry-based habitat restoration, repopulating native shellfish (oysters, mussels, soft shell clams), and restoring connectivity between salt marsh, eelgrass, shellfish habitats, and surrounding waters.

This approach and process will help re-integrate human beings and the rest of the nature on this small peninsula. Although this area was once part of the extensive salt marshes and oyster reefs thriving throughout the Harbor, many of us have forgotten how to be part of that nature. Using a biomimicry-based habitat restoration approach will contribute towards concrete goals of learning and practicing adaptation and mitigation responses to global climate change, including to sea level rise and coastal inundation, but more importantly it will help us heal together with that same nature that we have been degrading.

My future work will continue to share the knowledge of the harbor: its depth; its history of contamination and clean-up; and its migrating alewife. It is to share the harbor's beauty - what it has now, as well as the pain of lost eelgrass, salt marsh and oysters, and the joy for what can be regained. It is to let my students know I swim most days off Squantum beach, and how happy I am in the harbor and with them. This is my niche and area of expertise, my passion and my obligation to continue contributing to the EEOS, UMass Boston and the community at large.

My future work through GBH will include:

- **Developing and teaching Biomimicry courses in both EEOS and University College settings;**
- **Salt marsh, eel grass and oyster restoration on campus and better understanding of Boston Harbor natural systems (including human ones);**
- **Holistic Science on-line book form to share GBH and other stories;**
- **Establishing a broad network for "adopt a student for a green job" program;**
- **Collaborating with the University of Para's (Brazil) Coastal Studies Institute;**

Appendix #1: Teaching Summary Table

Category	Name	2005-2006		2006-2007		2007-2008			2008-2009		2009-2010		2009-2010		Totals
		Fall	Spring	Fall	Spring	Fall	Spring	Summer	Fall	Spring	Fall	Spring	Fall	Spring	
Courses															
(number of students)	Coastal Zone Management (EEOS 324)			23		14			21		33		50		141
	Coastal Zone Management (EEOS 726)					3									3
	Introduction to Oceanography (EEOS 226)		24		56		55	31		49		55			270
	Independent Studies (EEOS 479)									11	6	3			20
	Seminar in Environmental Sciences (EEOS 791)				25	25	27								
	Independent Studies (EEOS 796)			1		1	1								
	Coastal Ecosystem Management (EEOS 697)											13			13
	Dissertation								1	2	2	2			
Advising															
(number of students)	Undergraduate students				20	20			35		25				
	Graduate students	2		4		3			5		7				
Professional development participation															
	Center for Improvement in Teaching Seminar							X							
	Biomimicry Educators Training Workshop											X			
	STEM workshops								x		x				

Appendix #2: Graduate Student List

Student Name	Degree	Date entered	Date Graduated (Expected)	Thesis/Dissertation Topic	Fellowships/Grants	Awards
Anny Cataldo	MS	Fall 2004	Spring 2007	Site Suitability Analysis for Shellfish Spawning Sanctuaries in Wellfleet Harbor, Massachusetts		
Shelley Edmondson	MS	Fall 2005	Spring 2008	Site Suitability Analysis for Offshore Aquaculture of Sea Scallop (Plactopecten magellanicus), Martha's Vineyard, Massachusetts, USA	Watershed Integrated Science Partnership (2007-2008)	
Kimberly Starbuck	MS	Fall 2006	Fall 2008	Is there a 'Recipe' for a sustainable wild bay scallop (Argopecten irradians irradians) fishery on Nantucket Island, MA, USA		
Christopher McIntyre	MS	Fall 2008	(Spring 2011)	Boston Harbor marine invasive species assessment; Bosotn Harbor No Dischrge Area implementation assessment;	"Adopt a Student for Green Job:" the City of Boston (2008-2011); CZM internship (2010)	
Taylor Brown	MS	Spring 2010	(Fall 2012)	Shallow water coastal area habitat assessment, Cape Cod MA	"Adopt a Student for Green Job:" Provincetown Center for Coastal Studies (2010-2012)	
Vanessa Yandell	MS	Fall 2009	part-time student	Coastal water quality and human health issues		
Lisa Greber	PhD	Fall 2006	(Spring 2011)	'To dwell in the haven of the sea:' Finding holistic science tools and strategies to support coastal stewardship in Malibu and Waquoit Bays, MA	2007-2009 NOAA/NERRS Social Science Fellow; 2008-2009 Watershed Integrated Science Partnership Fellow	2010 Walter Jones Memorial… etc.; 2009 UMass Boston Beacon Award nominee
Seth Sheldon	PhD	Fall 2008	(Spring 2012)	Thermoelectric Power and the Environment: The Water-Energy Nexus in Massachusetts	"Adopt a Student for Green Job:" Civil Society Initiative (2010-2012)	
Erin Rempala	PhD	Fall 2010	(Spring 2014)	Preliminary assessment of salt marsh-eelgrass connectivity with implications for habitat restoration		
Zvejezdana Popovic (University of Split, Croatia)	PhD	Fall 2008	Fall 2011	Biology and population dynamics of Venus verrucosa in the East Adriatic Coast		

Appendix #3: Service Overview Table

KEY

- University
- CSM
- EEOS
- Professional
- Community

"Spring" = Jan 1 to June 30
"Fall" = July 1 to Dec. 31
Colored segments indicate activities within that time period.

Category	Name	2005-2006 Fall	2005-2006 Spring	2006-2007 Fall	2006-2007 Spring	2007-2008 Fall	2007-2008 Spring	2008-2009 Fall	2008-2009 Spring	2009-2010 Fall	2009-2010 Spring	CURRENT 2010-2011 Fall	PLANNED 2010-2011 Spring
University	AAC – Faculty Council Academic Affairs Committee												
University	BPECEE Business and Professional Education for the Clean Energ												
University	Jr. League Future You												
University	Management Plan Stellwagen Bank National Marine Sanctuary -												
University	Massachusetts Ocean Plan; Ocean Science Advisory Council												
University	Science at Sea												
University	UMass Boston Master Plan Architechture and Landscaping Subc												
University	Operation Wallacea												
CSM	Student Success Task Force Council												
EEOS	EEOS Graduate Admissions Committee												
EEOS	EEOS Seminar Speaker Series												
EEOS	EEOS Students Association Advisor												
EEOS	EEOS New faculty Hiring Committee												
Professional	Board Member Gulf of Maine Council on the Marine environment												
Professional	IGERT Panel												
Professional	Environmental science Graduate Program, Univ of Split												
Professional	Fellow of the CCRM, VIMS, College of William & Mary												
Professional	Grant reviews												
Professional	Land Court testifying												
Professional	Manuscript reviews												
Professional	Special advisor for Croatia Ministry of Culture												
Professional	EU CONSENSUS advisor												
Professional	Global Forum on Oceans, Coasts and Islands												
Community	EPA Bold Open House Tour and Research Cruise												
Community	Thompson Island Clean-up												
Community	Environmental Science Academy Advisory Board												
Community	Green Team Hyde Park, Neponset River Watershed												
Community	Habitat Restoration/DMF												
Community	Boat trip for visiting students from Tsingua University, China												
Community	YPIC = Young Professionals for International Cooperation												
Community	Indigenous knowledge and environment												
Community	Massachusetts Oyster Project												
Community	Boston Green Hotels												
Community	Dorchester Beach Festival												
Community	Foundation for Green Future - Boston Green Fest/green roofs												
Community	New England Friends of Croatia												
Community	Boston Shines												
Community	Mather Elementary School Outdoor Classroom												

Appendix #4: GBH Project Overview Table

KEY

Scholarship	"Spring" = Jan 1 to June 30
Teaching	"Fall" = July 1 to Dec. 31
1 Services	Colored segments indicate activities within that time period.

Category	Name	2005-2006 Fall	2005-2006 Spring	2006-2007 Fall	2006-2007 Spring	2007-2008 Fall	2007-2008 Spring	2008-2009 Fall	2008-2009 Spring	2009-2010 Fall	2009-2010 Spring	CURRENT 2010-2011 Fall	PLANNED 2010-2011 Spring
Scholarship	Eel grass restoration project											1	1
Services	Thompson Island Clean-up												
Scholarship	EPA/Mystic River Watershed												
Services	Green Team Hyde Park, Neposnet River Watershed										1	1	1
Services	Gulf of Maine Council on the Marine environment										1	1	1
Services	Habitat Restoration/DMF										1	1	1
Teaching	Biomimicry Education												
Teaching	Biomimicry Educators Training Workshop												
Teaching	Coastal Ecosystem Management (EEOS 697)										1	1	1
Services	Boat trip for visiting students from Tsingua University, China									1			
Services	Indigenous knowledge and environment												
Scholarship	Malibu Bay Environmental and Social Assessments												
Scholarship	Marine invasive species monitoring												
Services	Massachusetts Oyster Project												
Scholarship	Coastal Shochenet												
Scholarship	Patten Cove water quality study												
Scholarship	Adopt-A-Student												
Scholarship	Pump-out boat												
Scholarship	Water-energy nexus							1	1	1	1	1	1
Services	UMass Boston Master Plan Committee												
Teaching	Independent Studies (EEOS 479)							1	1				
Teaching	Students' Vision of the UMB Master Plan							1	1	1	1	1	1
Scholarship	Salt marsh restoration project						1	1	1	1	1	1	1
Services	Boston Green Hotels						1	1	1	1	1	1	1
Services	Dorchester Beach Festival												
Services	Science at sea												
Teaching	Center for Improvement in Teaching Seminar												
Scholarship	Climate as a common ground												
Services	Foundation for Green Future - Boston Green Fest/green roofs					1	1	1	1	1	1	1	1
Teaching	Coastal Zone Management (EEOS 726)					1		1		1		1	
Services	Green Roofs												
Teaching	Seminar in Environmental Sciences (EEOS 791)												
Teaching	Coastal Zone Management (EEOS 324)												
Teaching	Independent Studies (EEOS 796)												
Services	Boston Shines												
Services	Mather Elementary School Outdoor Classroom												
Teaching	Introduction to Oceanography (EEOS 226)												
Teaching	Thesis/Dissertation												