Greetings! The Coastal Studies Center encompasses 118 acres with 2.5 miles of shoreline between Harpswell Sound and Long Cove on Orr’s Island, 13 miles from campus. Coastal Studies supports a variety of research programs, including geology, biology, marine biology, environmental studies, and archaeology and seeks to inspire faculty and student research and creative projects from all disciplines of the College.

For the first time this year, over 100 incoming first-year students visited the property during Pre-Orientation for an immersion in the beauty and complexity of this Orr’s Island location. We hope they return to visit often over their four years at Bowdoin, either as part of a class to study the area further or on their own to walk the trails. This invitation extends to all members of our college and local community.

**Research and Teaching**

Several long-term field studies continue on the property, in addition to new field and lab work. Lab Instructor Jaret Reblin established terrestrial salamander monitoring transects at the Coastal Studies Center about 10 years ago, and students in *Perspectives in Environmental Science* have visited the site to quantify salamander abundance, object preference, sex, size, and condition yearly since that time. The students also work with the entire database to answer questions about salamander abundance over time and preference for certain types of objects.

In Biology/Environmental Studies 215 *Population Biology and Behavioral Ecology* students use the Coastal Studies Center to identify common trees and shrubs, and as a place to think about how plants “behave” to accomplish essential functions, such as how to get pollinators, or allocate resources between growth and reproduction, or convince animals to disperse their seeds. Students also visit tree plots to census tree growth as a way to quantify carbon sequestration in northern forests. Professor Lichter established the plots 10 years ago and there is now an on-going database of the growth since that time. Students will later work with the data to learn skills in data management and analysis.

The Marine Lab is an integral part of Professor Amy Johnson’s *Marine Biology* class. Students in the class collect animals in the inter-tidal zone and examine them in the marine lab, conduct their natural history labs there, and take the lab final exam using the water tables and teaching animals.

Damon Gannon’s *Marine Conservation Biology* class (Biology/Environmental Studies 274) made three field trips to the Coastal Studies Center to perform detailed surveys of the algal and animal communities bordering the property. Such surveys can be used to document the arrival of invasive species and changes in biodiversity over time. Finally, students in Biology 109: *Introductory Biology* visited Giant Stairs in Bailey Island and the Coastal Studies Center to measure periwinkles to see whether there is a difference in average animal size based on their location and exposure to waves.
Researchers from the University of Maine at Machias hung larval collectors from the floating docks as part of a state-wide Marine Invasive Species Monitoring Project. Professors **Wendy Norden** and **Doug McNaught** outfitted PVC tubes with sponges inside to collect marine invertebrates from coastal locations throughout the state. The project is gathering information to learn more about displacement of native species by invasive species, which can have wide-ranging impacts on marine biodiversity and local economies. Norden and McNaught will be presenting the project results at the International Marine Invasives Conference in Woods Hole, MA, in April of 2010.

**Scott Santagata**, an Assistant Professor of Biology at the C.W. Post Campus of Long Island University spent a week at the Marine Lab this summer. Scott is an evolutionary biologist with interests in the development, evolution, and ecology of aquatic invertebrates. He focuses his research on marine invertebrates because their diverse forms serve as unique models for understanding evolutionary and ecological relationships among multicellular animals. At the marine lab Scott preserved the larvae of several species of bryozoans (a phylum of aquatic invertebrate animals) to investigate the expression of conserved developmental genes involved in the specification of neuronal cell types.

Scott Santagata

Jon Allen and Jill Dixon

**Jonathan D. Allen**, Assistant Professor of Biology at Randolph Macon College (RMC), (and Bowdoin’s Doherty Marine Biology Scholar ’06–’08) returned to the Marine Lab with three RMC students. **Jill Dixon** ’09 worked to investigate the effectiveness of encapsulation as a defense against predation for the embryos of *Nucella lapillus*, the dogwhelk. She found that egg capsules are, on their own, insufficient to prevent significant levels of predation from occurring. This result is contrary to the common wisdom described in prior literature. Jill’s work followed up on work done by Doherty fellow **Rachel Dicker** (Bowdoin ’08) that showed that *Nucella* laying behaviors in the field are non-random and are likely influenced by tidal height and exposure to predators and environmental stresses such as heat and desiccation. **Amanda Santoni** ’10 focused her research on another intertidal gastropod, the mudsnail *Ilyanassa obsoleta*. Amanda studied the effects of the presence of several predators on the laying behavior of *Ilyanassa*. She found that mudsnails respond to crab predators by increasing their investment in reproduction by laying more eggs in their benthic egg capsules. Amanda also found that *Ilyanassa* produce longer spines on their egg capsules in response to hermit crab predators, presumably as a mechanism for deterring predation on the eggs. **Cara Carne** ’10 investigated the effects of environmental changes in temperature and salinity on development in the seastar *Asterias forbesi*. Cara found that under some combinations of elevated temperature and reduced salinity, *Asterias* embryos undergo a dramatic twinning at the two-cell stage. This results in twin embryos that develop within a single fertilization envelope and hatch as normal looking embryos. This research has significant implications for changes in the recruitment of *Asterias* under changing climate conditions. Cara also examined the effects of natural variation in egg size on the larval development of *Asterias*. Unusually, this species produces eggs that vary up to twofold in volume within a singe clutch. The size of the egg leads to significant changes in developmental rate, as predicted by theory, but this has only rarely been demonstrated empirically.

**STUDENT FELLOWSHIPS**

Sixteen Bowdoin students were awarded fellowships for coastal or marine faculty-mentored summer research summer 2009. The projects spanned multiple disciplines, including biology, ecology, geology, visual art, environmental studies, marine biology and chemistry. While some of the work took place at the Coastal Studies Center, utilizing the marine lab, terrestrial lab, the dock or grounds, other projects were based in the mid coast region or on Bowdoin’s main campus. Three students from Randolph Macon College joined Jonathan Allen (Doherty Marine Biology Postdoctoral Scholar 2006-2008) and some of the Bowdoin fellows at the marine lab. All the students presented research findings or an overview of their artistic projects at seminar sessions at the Coastal Studies Center in July.
Caitlin Beach ’10 was awarded a Rusack Fellowship for her proposal “Toilers of the Sea- Depicting Coastal Industry in early Twentieth Century American Art” Caitlin worked under the direction of Professor of Art Linda Docherty. Caitlin’s research explored the representation of Maine’s coastal industry in the landscape art of the early twentieth century. The questions she raised in her project present a certain relevance to the nature of Maine coastal society today. “At a time when small coastal industries, particularly lobstering are waning, the question of how themes of labor and landscape are represented informing reality becomes increasingly pertinent”. Andrew Bell ’11 received a Freedman Fellowship to work with professor of Biology John Lichter on his project: “Submerged Aquatic Vegetation and Anadromous Fish in Merrymeeting Bay”. Andy’s research expanded on previous student research begun last year with a study of the importance of submerged aquatic vegetation (SAV) habitat for juvenile anadromous fish such as alewife, river herring, and American shad. Andy sought to resolve questions about nursery habitat of anadromous species to provide insight into the cause of the slow recovery of fish populations. Alexandra Brasili ’10 worked with Professor of Marine Biology Amy Johnson in the Marine Lab on her Rusack Fellowship project: “Temperature and growth in the green sea urchin Stronglocentrotus droebachiensis”. This project looked at the relationship between growth, temperature and size in the green sea urchin. The demand for green sea urchins in Maine has led to their decline, from a biomass of 61,000 tons in 1987 to 11,000 tons in 2004. Once urchin beds are overfished, other forms of sea life move in, making recolonization efforts extremely difficult. This project focused on the process of sea urchin growth and how such knowledge could be put to use in restoring sea urchin populations in the Gulf of Maine. Shem Dixon ’11 was awarded a Rusack Fellowship for a project with Biology professor Barry Logan to determine “the effects of mistletoe infection on shading and photosynthesis in white spruce”. The parasitic Eastern dwarf mistletoe (Acrethobium pusillum) has devastated the white spruce tree forests along the Atlantic coast. These parasites cling onto the host and slowly drain the life out over the course of ten to twenty years, by forming “witches brooms”. Part of a team-effort, this project constructed a chamber to enclose and seal an infected branch. The chamber was used to measure the rates of photosynthesis, yielding data that can aid in the understanding of just how the brooms actually function. Katherine Doubleday, ’11 was awarded a Doherty Fellowship to study the “Effects of coral hybridization on specificity of coral-Symbiodinium symbiosis in Caribbean reef-building corals” with Doherty Marine Biology Postdoctoral Scholar Dan Thornhill. Katherine explored the degree of hybridization between two dominant Caribbean corals in the Florida Keys and the Bahamas. The symbiont and coral data both indicated hybridization in the Bahamas, but little to no hybridization in the Florida Keys. The research has led to more questions, including: what environmental differences between these regions are leading to different evolutionary paths in these corals, and, will climate change affect these regions differently? Whitney Grass ’10 received a Kibbe Fellowship for her project: “Exploring Nutrient Dynamics in the Androscoggin Lake Watershed: Bioavailable Phosphorus in Agricultural runoff” under Geology Professor Peter Lea’s direction. Whitney’s research followed up on watershed research conducted by Lea’s Watershed Hydrology course and analyzed non-point sources of nutrient loading along the Dead River, particularly in regard to agricultural influences. Adam Hall ’09 worked with Professors Dharni Vasudevan (Chemistry and Environmental Studies) and John Lichter (Biology and Environmental Studies) on his Doherty Fellowship “Phosphorus Pollution on Sediments of Merrymeeting Bay”. Merrymeeting Bay is a large freshwater tidal estuary at the confluence of the Androscoggin and Kennebec Rivers which has suffered from extensive pollution during the mid-20th century. Any recovery effort will depend on both eliminating pollutant sources and determining how quickly polluting compounds already in the Bay can leave. This project looked at the level of phosphorous in the sediments of Merrymeeting Bay, providing information for any recovery effort. Samuel Hankinson ’10 was awarded a Rusack Fellowship to conduct his project with Geology Professor Edward Laine. Sam investigated “the influence of oceanographic and hydrological factors on blooms of the harmful phytoplankton Alexandrium fundyense in Harpswell Sound.” Harpswell Sound is the home of recurring blooms of A. fundyense, with the largest bloom occurring during the spring season. In 2008
however, the ‘spring bloom’ occurred long before it was expected. By examining the record of river discharge for the Kennebec, time series of temperature from the buoy in Harpswell Sound and GoMoos buoys in nearby, and two years of twice weekly discrete sampling in Harpswell Sound, this investigation focused on determining whether the freshwater input was sufficiently large to influence water temperatures enough to create a suitable environment for a bloom of *A. fundyense*, or if there were other factors involved in warming the water, such as currents from shallower regions of Casco Bay.

William Hatleberg ‘11 received a Doherty Fellowship to work with Dan Thornhill on his project “Diversity of Host/Symbiont Endosymbiosis in Marine Siboglinid Worms”. Symbiosis are close and sustained biological relationships between two species. One prominent example of symbiosis is the relationship between siboglinid worms and their bacterial symbionts. Siboglinid worms rely on endosymbiotic bacteria for all forms of nutrition, which are housed within a unique organ called a trophosome. The goal of this project was to understand the establishment and evolutionary development of bacterial symbiosis in metazoans. Jane Koopman ‘10 worked with Geology Professor Peter Lea on her Doherty Fellowship project: Dynamics of Estuarine Sand Dunes in Merrymeeting Bay”. Merrymeeting Bay is a large tidal, freshwater bay that feeds Maine’s coastal beaches with sand. With rising global sea levels however, there is concern that much of this key sediment supply could be trapped in the bay and estuary, depriving Maine’s coast of its lifeblood. Jane observed the sand dunes of the bay over a period of time and correlated this data with flow data obtained through Bowdoin’s Acoustic Doppler Current Profiler (ADCP) and side-scan sonar. She looked at the relationship between dune characteristics and flow variations. Jane’s data provides a better understanding of both the spatial and temporal variation of how sand moves within these dunes in response to changing currents. Molly Kwiatkowski ‘11 was awarded a Doherty Fellowship and worked with Chemistry Professor Patsy Dickinson (Doherty Fellow ‘06) suggests that the protective sheath might prevent some hormones from reaching the nerves and thereby raises questions about the accuracy of this technique. This study surveyed the role of the sheath as a barrier to hormones in the stomatogastric nervous system of the American lobster. Danielle Marias ‘10 received a Rusack Fellowship for her project “Three dimensional model of witches broom architecture to assess light capture and photosynthesis in mistletoe-infected white spruce” which was supervised by Professor Barry Logan. Danielle used a computer model of plant architecture, Y-plant to examine the impact of growth deformations on self-shading and photosynthesis in white spruce infected with the parasite dwarf mistletoe. Mistletoe infection upsets host developmental regulation, resulting in dense branching which may lower tree rates of photosynthesis via self shading. Laura Newcomb ‘11 worked with Dan Thornhill on her Rusack Fellowship project “Investigating the nature of a temperate coral symbiosis”. Laura investigated a local example of symbiosis between corals and *Symbiodinium* that exists in the Gulf of Maine, the coral *Astrangia poculata*. Here, only a single species of *Symbiodinium*, known as B2 can withstand periods of low temperature and recover when temperatures are raised. Considering the low temperatures in the Gulf of Maine it is unclear how *Symbiodinium* B2 could be providing energy to *A. poculata*. Laura’s research sought to determine the nature of the symbiosis between *A. poculata* and *Symbiodinium* B2, investigating the hypothesis that the relationship between *Symbiodinium* and *A. poculata* is no longer a mutualism but has shifted into a parasitic relationship with *Symbiodinium* gaining at the coral’s expense.

Emily Norton ‘10 was awarded a Doherty Fellowship to work with Amy Johnson and Olaf Ellers in the Marine Lab on her project “Mathematical modeling of underwater walking in three species of intertidal crabs”. The goal of this project is to improve models used to describe underwater walking and make predictions about which animal morphologies and densities are favorable for walking and which are not, using a Froude number equation that takes into account buoyancy, added mass and damping. Emily used three species of crab found on the Maine coast, filming and analyzing crabs of different sizes and species walking at different speeds and compared the results to previous research.

Emily in the marine lab

![Siboglinid worms](Photo credit: Greg Rouse or Bob Vrijenhoek)
A hard working contingent of students, staff, kids and alumni gathered at the property in mid-September to clear trails and the shoreline for Bowdoin’s annual Common Good Day. Participating were: Julian Ireland, Lisa Tessler ’79, Andrew and Margaret Chingos (children of) Sarah Chingos (Program Placement and Outreach Coordinator for Bowdoin’s Education department), Mark Murray (Coastal Studies Center caretaker) Colin Matthews ’10, Carina Sandoval ’10, Evan Graff ’11 and Evan Fricke ’11.

At the invitation of the Orr’s and Bailey Islands Yacht Club, Collin Roesler, Associate professor of Geology joined many neighbors of the Coastal Studies Center in July for dinner before giving a talk about the oceanographic buoy in Harpswell Sound. Her talk was titled: “Secrets of Harpswell Sound Revealed: How real time hourly observations change our view of oceanic ecosystems”.

Elissa Rodman ’10 accepted a Rusack Fellowship to pursue her project “Deconstructing the perceived realities of Maine’s identity: a study in painting and photography” under the direction of Visual Art Professor James Mullen. In this project Elissa examined the origins of the perceived realities of coastal Maine to understand the functions and ramifications of constructed identity more thoroughly. The typical modes of dissemination for the characteristic Maine identity are through painting and photography, and Elissa researched and worked in both media. She sought to understand how the specific media affect the collective unconsciousness, and to learn how to manipulate the art forms in order to relay meaning.

Terrawat Wiwatpanit ’11 received a Doherty Fellowship on his project: “How SYWKQCAFNAVSCFamide, a peptide from C-Type allastostatin Family, modulates heart and cardiac ganglion of the American Lobster”. The results from this study will contribute to our understanding of the functions of the novel peptide family, C-Type allastatins. Together with the findings from past studies, the project goal was to better understand the complex modulation of the lobster heart neuro-modulation, forming fundamental evidence for publication and presentation.

**COASTAL STUDIES SCHOLAR**

Vladimir Douhovnikoff, Assistant Professor of Biology at Simmons College spent the 2008-2009 year at Bowdoin as the Coastal Studies Scholar and adjunct lecturer in Biology and Environmental Studies. In the Fall, Vlad and his class of first-year students explored the basic principles of ecology and environmental science in the course *Ecology and Society*. The course grounded the students in interactions between humans and their environment (biotic and abiotic). Through lectures and field exercises the students were exposed to the unity and interconnections of the processes that drive ecological health. The relevance of ecology to today’s society was an area of concentration with emphasis on natural resource use and conservation. One of the aims of the course was to give students the basic ecological tools they need to be informed world citizens.

While at Bowdoin, Vlad also spent considerable time studying Phragmites along the New Meadows River, in West Bath near the Bowdoin campus. This invasive grass has expanded into salt and fresh water marshes along coastal Maine. Clonal growth is extensive in Phragmites populations, and is what Vlad expected to find. However, preliminary results show high levels of reproduction by seeds (sexual reproduction) in the local populations studied. If these results hold up, they will challenge researchers to determine what makes Phragmites such an effective invader of wetlands, as this research disputes clonal growth as the cause. The research has implications for new potential methods for the management of the species. Vlad Douhovnikoff received his Ph.D. (Wildland Resource Science), M.S. (Forest Science), and B.A. (Social Science Field Major) from the University of California, Berkeley.
The Coastal Studies Center was a destination for five Pre-Orientatio

n trips this August. Forty students participating in the Community Immersion Pre-Orientation service trips organized through the McKeen Center for the Common Good spent their first day at the Coastal Studies Center. The rest of the week was spent working on social, economic and environmental issues facing mid coast Maine. The students completed daily service projects, field trips, discussions with staff from area non-profits, nightly reflective discussions, and social activities supporting local businesses.

Two kayaking groups exploring the local Maine coastline and waterways each camped at the Coastal Studies Center for a night, and joined a third pre-o group who spent the week on-site hiking the trails, canoeing along the shore, learning about the coastal ecology of Maine, and exploring activities related to health and wellness.

A group of twenty-six incoming first-year students participating in Bowdoin’s Science Experience program spent a rainy afternoon and early evening with their mentors and instructors at the Coastal Studies Center. The students explored the dock, marine and terrestrial labs, played frisbee in the field and had an indoor picnic—a high-light of their first week on campus. Bowdoin Science Experience is an intensive 5-day Pre-Orientation program which aims to encourage students who have indicated an interest in math or science and who are traditionally under-represented in these fields. This includes under-represented minorities, first-generation students, women in the physical sciences, and students from rural Maine.

**Faculty Research Awards**

**Damon Gannon**, Bowdoin Scientific Station and **Nancy Olmstead**, Department of Biology, “Behavior and ecological impacts of an island population of muskrats (*Ondatra zibethicus*)”, (Phocas Family Research Award).

**Ta Herrera**, Department of Economics, “Sustainable coastal development in Miches, Dominican Republic”, (Phocas Family Research Award).


**Jim Mullen**, Department of Visual Art, “Extended Images: Investigating the Depiction of Space in the Coastal Landscape”, (Rusack Award).

**Dan Thornhill**, Department of Biology, “Investigating the Nature of a Temperate Coral Symbiosis”, (Rusack Award).

**Katherine Lee Mitterling** (2006). Differences in hippocampus and septum volumes in storing and non-storing birds across seasons. Honors Thesis. Neuroscience (This honors project listing was omitted from the 2005-2006 annual report in error).

**Thomas Ward Buehrens** (2007). Juvenile salmonid use of Whidbey Island’s nearshore habitats in Admiralty Inlet and the Strait of Juan de Fuca. Honors Thesis. Biology (This honors project was omitted from the 2006-2007 annual report in error).


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Summer ’09 summer fellows:
Alex Brasil, Emily Norton, and Laura Newcomb


**Gardner, R.D., **Law, L.M., **Drumheller, K.M., Allen, T.A., and Lee, D.W. Species-specific injury-induced cell proliferation in the hippocampus and the subventricular zone of food-storing and non-storing wild birds. CSULB All University Celebration of Research, Scholarly, and Creative Activity, April 2009.**

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