Last May after commencement, about a dozen USC undergraduates took up residence on Catalina Island to study “Methods in Oceanography and Marine Biology” at the USC Wrigley Marine Science Center. This course, sponsored by USC Dornsife, is an intensive combination of class work and field research, and the May 2012 group was exceptional, according to USC Wrigley Institute faculty Karla Heidelberg, Assistant Professor of Biological Sciences in USC Dornsife and one of the faculty instructors of the course. “Hands down, this was the best class I have had at USC,” Heidelberg said. “We pushed these students hard, and they rose to the occasion every time. They enthusiastically came together as a team in all aspects of the course—the research, the presentations, the late night work and the weekend social activities.”

The Maymester classes on Catalina Island are designed to teach complex concepts through intensive class work and independent field research. The first three weeks of the course involved guided research activities. In the fourth week, the students conducted an independent science research project using scientific methods, professional research equipment, and statistical analysis of data. At the end...continued on page 7

From the Director

As the summer draws to a close, there are many wonderful things to report. We began our busy season with the news that the Wrigley Institute will be awarded funds from the U.S. National Science Foundation to build a research greenhouse at the Wrigley Marine Science Center on Catalina Island! The greenhouse will advance our growing interests in sustainable food and energy production, including phytoplankton in support of aquaculture studies (stay tuned for a feature story in our next newsletter). It also will support studies of terrestrial species that are native to Catalina Island and house closed seawater systems in support of research on microbial fuel cells and biofuels. We look forward to hosting more solutions-oriented research and researchers and facilitating the collaborations that will result from these exciting research activities. We offer special thanks to the NSF Division of Biological Infrastructure for its support and to USC faculty collaborators Doug Capone, Dennis Hedgecock, Karla Heidelberg and Sergey Nuzhdin for a job well done. We also had the privilege of welcoming Steve Kay, the incoming Dean of the USC Dornsife College of Letters, Arts and Sciences, to the...continued on next page
From the Director continued from page 1...

Wrigley Marine Science Center for a brief visit in mid-July. Steve and several members of our Advisory Board spent a wonderful morning in the Boone Center discussing the history of the Wrigley Institute and the Wrigley Marine Science Center, and they later toured the laboratory and housing on campus and in Two Harbors, chatting with students, researchers and staff along the way. We learned that Dean Kay is a “natural” for us. He’s a native of the Isle of Jersey and an avid sport fisherman, boater and diver. He also is a highly respected and well-published scientist with significant interests in environmental sustainability.

We are lucky to have such an esteemed scientist at the Dornsife helm, and we eagerly await his arrival in October.

Looking forward, we have an exciting fall before us. Football season is here, and one national poll has USC ranked at the top. Very cool! But even cooler is a new seminar series on the topic of biodiversity that is sponsored by the Wrigley Institute, the USC Department of Biological Sciences and the Natural History Museum of Los Angeles County. Thanks to an internal award from the Office of the Vice President for Research, we will host a series of high-profile speakers who will address questions such as “What is biodiversity?” and “Why is it important?” Join us as we travel through different ecosystems and learn how they might respond to a changing world and how their structure and function is intimately tied to the species within them. A full schedule is posted on the Wrigley Institute website. Bring your friends and stay for an informal social hour to meet and hobnob with speakers, USC faculty and grad students.

As always, we thank you for your support, we welcome your participation and we hope you enjoy our newsletter.

Best wishes,

Roberta Marinelli, Ph.D.

MORE USC STUDENTS WORK ON WRIGLEY MARINE SCIENCE CENTER TRAIL

by Richard Hoops

Four USC undergraduate students worked this past summer to enhance a hiking trail that was built in 2011 on Catalina Island at the edge of the USC Wrigley Marine Science Center campus. Like the project last year, the students’ work on the trail in Deer Valley was a collaboration involving the USC Dornsife Environmental Studies Program and the Catalina Island Conservancy.

The USC students also worked with the Conservancy to remove invasive vegetation from other spots around Catalina Island. In addition, they installed interpretive signs along the Deer Valley Trail and set up test plots to monitor the succession of plants in areas that were cleared of fennel last year. In September and October, these same students will work with the Conservancy on restoration of native plants along the trail.

The students received stipends from USC Dornsife Undergraduate Research Associates Program, and the USC Wrigley Institute for Environmental Studies provided housing for them at WMSC. The project is led by faculty from the USC Dornsife Environmental Studies Program including: Jim Haw, Ray R. Irani Chairman of Occidental Petroleum Chair in Chemistry, professor of chemistry and director of environmental studies; David Ginsburg, Assistant Professor (Teaching) and Lecturer Lisa Collins.

Haw and Ginsburg also are co-instructors in the USC Dornsife Maymester scientific diving program, and all four of the students have participated in the Maymester trips to Guam and Palau. Bogda went on the Maymester trip in 2011; Fong, Holle and Tellez were on the Maymester expedition this year and went straight to Catalina Island after the trip was over in June.

The USC students surveyed a watershed on the east side of Santa Catalina Island.

Judy Fong mows a plot using pruners.

USC students survey a watershed on the east side of Santa Catalina Island.

Photo by Stephen Holle
Faculty and staff with the USC Department of Physics and Astronomy have talked for years about hosting “star parties” on Catalina Island at the Wrigley Marine Science Center. It’s a perfect place for such events, far removed from the lights of Los Angeles, and faculty and staff with the Wrigley Institute were enthusiastic about the idea. The biggest challenge was simply in getting a good telescope from the main campus to the waterfront in San Pedro, across 20 miles of water to the USC labs on Catalina Island and back again to campus.

Joseph Vandiver, laboratory manager for the USC astronomy department, met the challenge by putting a 12-inch telescope on a one-way trip to the island.

“Years ago, a colleague wanted to see if our astronomy grad students were interested in hosting ‘star parties’ for the groups that stay at the Catalina Island labs,” Vandiver said. “This seemed like an interesting idea, but it wasn’t likely to happen given the issue of hauling telescopes back and forth. Then it occurred to me to ‘donate’ a telescope to be housed on the island. We had a nice, but older, 12-inch telescope that we weren’t using. I thought it could be put to good use out there.”

The instrument was well-suited for astronomy, but it had limitations in the field.

“The sheer size and weight of the telescope makes it almost impossible for one person to manage,” Vandiver said. “Now we use eight-inch telescopes in our observation sessions for portability and ease of use. Putting the 12-inch telescope in a more permanent observatory will make it much more user-friendly.”

The chair of the USC physics and astronomy department, Professor Werner Däppen, approved the donation to the Wrigley Institute. Vandiver made it happen with the help of two Wrigley Institute staff—Lynn Whitley, director of pre-collegiate education, and Sean Conner, operations manager at the Wrigley Marine Science Center—and the telescope was shipped to the island in April.

Vandiver worked with Conner and a scientist at the NASA Jet Propulsion Laboratory, Thomas E. Nolan (BS, Biological Sciences, ’77) to show the WMSC staff how to use the telescope. The first “star party” was held in June. The event was organized for a group of middle school students who competed in the 2012 QuikSCience Challenge and were staying at WMSC for a week as first place winners. They had an opportunity to use the telescope with the help of Terri Bidle, QuikSCience Program Manager with the Wrigley Institute, and Jennifer Shitanishi, a USC Ph.D. candidate in physics with an emphasis in astrophysics and cosmology.

“We’re grateful to Joe and the rest of his department for this donation,” Conner said. “It will enrich the Catalina experience for years to come.”

The telescope will be mounted on a permanent fixture with a lightweight structure that will protect it from the elements.

“The shelter can be easily removed so the telescope is accessible to stargazers,” Conner said. “It’s great to have this gift that allows us to look beyond our horizons and into distant galaxies.”

Catalina Island Lab Preps for “Star Parties”

by Richard Hoops

The USC Wrigley Institute for Environmental Studies (WIES) is uniquely positioned to play a leadership role in environmental education and research. You are cordially invited to join us in this ambitious and meaningful endeavor.

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Photo by Ann Close
The route Joshua West took to his office on the USC campus in Zumberge Hall passed through Yale University in New Haven, the University of Cambridge in England, and Olympic venues in Athens and Beijing.

“I took a while on my dissertation,” said West, an assistant professor in the USC Dornsife Department of Earth Sciences, the Zinsmeyer Early Career Chair in Environmental Geochemistry and a USC Wrigley Institute faculty member.

West, a native of New Mexico, headed to Yale in 1994 to study geology and geophysics and immediately was recruited for the school’s rowing team. His academic and athletic careers continued in the United Kingdom, where he entered graduate school at Cambridge and joined its rowing team. His success with the crew led to a position on the British national team and two trips to the Summer Olympic Games. He completed his Ph.D. at Cambridge in 2009 and joined the USC faculty in 2010.

West has recruited staff, students and funding to initiate a research program at USC in “low temperature geochemistry,” the opposite of the high temperature geochemistry that melts rocks and blows up volcanoes.

“Most of the chemical reactions we study are mediated by water interacting with rocks,” West said. “Rainwater falls on the surface and a whole series of chemical reactions take place as the water passes through soils and groundwater systems and eventually comes out in the ocean.”

Much of West’s research is focused on the very outermost parts of the solid Earth, what scientists call the “Critical Zone.”

“The Earth is this gigantic planet with a very thin skin at the surface,” West said. “That thin skin is where we live, and much of it is governed by chemical exchange with the bulk of the solid Earth. My research is about that chemical exchange: it’s about how mass moves between the rocks—the lithosphere, the crust of the Earth—and soil, water and air.”

West’s research projects fall into three broad categories: mass fluxes between the crust of the Earth and the surface, the use of isotopes to evaluate past climates, and mineral carbonation, particular the fixation of atmospheric carbon dioxide into solid minerals as part of the global carbon cycle.

Mineral carbonation and greenhouse gases
West is working on a project to determine if natural processes that remove carbon dioxide from the Earth’s atmosphere can be accelerated to sequester some of the greenhouse gas.

“Think of the White Cliffs of Dover,” West said. “They’re all chalk, calcium carbonate, and all of that carbon, at one point in Earth’s history, was in the atmosphere.”

The chemical reactions that created the white cliffs along the British coast someday might be used to sequester carbon dioxide that we’re putting into the atmosphere by burning fossil fuels.

“Geologic processes transform calcium and magnesium carbonate into natural sinks for atmospheric CO2,” West said. “If we can take those natural processes and speed them up, we might find a way of storing CO2 in a stable and secure form.”

The key reactions are the dissolution or chemical weathering of these minerals, and West is studying that process.

“These reactions take silicate minerals, particularly calcium and magnesium which have ions that carry a positive charge, and bond them to a silicon and oxygen complex,” West said. “The reactions divorce the calcium and magnesium from their silicate structure and make them sponges for CO2.”

West says this process might offer a partial solution—although only a partial solution—to the daunting task of dealing with global climate change.

“This is hardly a silver bullet,” West said. “It’s one potential solution, and we’re researching it because we think it has exciting potential.”

Isotope proxies
West also studies the use of isotopes in rock to analyze ancient climates.

“We’re interested in making use of isotopic proxies, which are the different isotope ratios in different elements,” West said. “There has been a technological revolution in the range of analyses that we can do, and advances in instrumentation let us analyze isotope ratios of elements that we could never measure before.”

Isotope ratios in elements change as a result of fractionation, naturally occurring processes that include melting or crystallization of rocks and minerals.

“Fractionation causes changes in isotope ratios,” West said, “and geochemists have been working for the last 15 years to understand what these changes in the geological record can tell us.”

The ratios of isotopes that follow these geologic processes can be used to determine palaeotemperatures and the modes of formation of rocks and minerals.

“The climate today is changing—whether it is being forced by human activity or not—and these geological snapshots offer an opportunity to understand where climate change might be taking us,” West said.

Mass fluxes
The movement of material over a designated boundary in terms of volume
and time is called “flux,” and the flux between the crust of the Earth and the surface is a major element of West’s research program at USC.

“We want to understand how mass, particularly carbon, is moving from the solid earth to the surface and back,” West said.

“One of the key processes in this flux is physical erosion,” West said. “Erosion is constantly distributing mass around the Earth’s surface through landslides, the transport of sediment by rivers and so on.”

West has support from the National Science Foundation to study the extreme disturbance to China’s Yangtze River following a 7.8-magnitude earthquake in 2008. The earthquake triggered widespread landslides in the catchment area, which includes the massive Three Gorges Dam. West, along with USC earth sciences professor Douglas Hammond and colleagues in the UK, Germany, and China are working on a three-year project to study the fate of the material dislodged by the 2008 earthquake and to measure the amount of suspended sediment in the river and the concentration and flux of particulate organic carbon in the sediment before and after the seismic event.

In addition, West is studying the mountains of Taiwan, which he describes as “one of the most rapidly eroding environments on Earth,” to measure the mass fluxes of carbon. He also had a paper published in July in the online edition of Geology, the journal of the Geological Society of America, about the chemical weathering of rock at the Earth’s surface and of its implications for the global carbon cycle.

**Athletics**

West was born in Santa Fe, New Mexico, and he discovered a path to the Olympic Games on the rivers of New England.

“I got into rowing when I went to Yale,” West said. “It’s more popular on the East Coast, and it’s a sport that you can start at a relatively old age because you reach your peak in your late 20s.”

Rowing also is a sport that favors taller athletes, and West is 6’10”. Taller athletes have longer limbs, and that gives them an advantage in rowing because they have longer, more efficient strokes and can take fewer strokes than shorter rowers to cover the same distance.

West raced in the Yale–Harvard Boat Race in 1998, and the next year he was off to the United Kingdom and graduate school and rowing at Cambridge.

“It’s an even bigger sport at Cambridge,” West said. “It’s analogous to football at USC.”

West was on Cambridge teams that raced Oxford University from 1999 to 2002, winning half of those encounters. “The Boat Race,” as it’s known, covers four miles of the River Thames in South West London.

“Tens of thousands to hundreds of thousands of people show up,” West said. “The banks are packed all four miles, but it would be grandiose to suggest that all those people are actually there to watch the rowing. It’s a spring day in late March or early April, and it’s all about going to pubs along the river, having a few drinks on a Sunday, and watching these two boats go by.”

During his time at Cambridge, West had an opportunity to try out for the British national rowing team and he won a position with it for eight seasons between 2001 and 2008. His team was in the World Rowing Championships six times, always finishing in the top 10, twice winning silver and once winning bronze. The British team also went to the 2004 Olympic Games in Athens, where it finished ninth, and to the 2008 Olympiad in Beijing where it won silver.

“I was rowing part time while I was working on my Ph.D.,” West said. “But for a full 18 months before the Olympics in Athens and in Beijing, I was devoted 100 percent—well, maybe 90 percent—to training.”

“It’s fantastic,” he said of the Olympic experience. “It’s thrilling beyond belief but it’s nerve wracking, too. You’ve put everything into preparing for the event then you have everything on the line.”

West has left rowing behind as he heads further into his academic career.

“Occasionally when I go back to the UK, I’ll hop in a boat but it’s nothing serious,” West said. “I don’t row here in California, though. The demands of being an assistant professor are rigorous enough!”
Since July 2009, USC has had Captain Gordon Boivin at the helm of its fleet, first with Zephyrus and now with Miss Christi. Captain Boivin holds a U.S. Merchant Marine Officer license, and USC hired him as the designated captain of any USC vessel transporting students and faculty to and from the mainland. The only other staff person who has similar approval is Trevor Oudin, who serves as the USC relief captain to back up Boivin and is the captain of Miss Christi on weekends.

In addition to his credentials as a captain, Boivin has a long history in diving. Before he started work with the Wrigley Institute as a USC employee, he already was a volunteer at the Wrigley Marine Science Center with the USC Catalina Hyperbaric Chamber, serving as an active crew member and decompression chamber supervisor.

Boivin started working as a commercial diver in the 1970s, and his credentials include training at the North Sea Medical Centre in the United Kingdom and certification as a recreational scuba instructor from the National Association of Underwater Instructors. He worked as a diving medic and commercial diver and in 1986 began a consultation project in Vancouver, British Columbia, for the Search and Rescue Branch of the Canadian Coast Guard. He helped develop its first rescue swimmer school and served 10 years as the senior instructor of the Canadian Coast Guard Rescue Specialist program. In 1990, he retired from the position, and he and his wife Tammy moved to Southern California. He became active again in the diving community and joined the management staff of Sport Chalet, where he was in charge of company-wide dive operations and training. In his work with the USC Catalina Hyperbaric Chamber, Boivin has developed a class titled “Emergency Response Diver,” a nationally accredited advanced scuba rescue class, and he is its primary instructor.

Boivin is involved with the reserve and regular deputy units of the Los Angeles Sheriff’s Department Special Enforcement Bureau as a diver and instructor. He’s a sworn Professional Services Officer with the Orange County Sheriff’s Department dive team and Harbor Department. He is also a member of the U.S. Coast Guard Auxiliary and serves as a member of the Dive Casualty Investigations unit to assist with dive-related fatality investigations in the Los Angeles Sector.

A note about the boat:
The vessel that Boivin drives, Miss Christi, was purchased by USC in February 2011. The Miss Christi can travel from its home berth in San Pedro to the dock at the Wrigley Marine Science Center in less than 90 minutes. The vessel also has a Certificate of Documentation from U.S. Coast Guard, an essential requirement for using it to carry students to and from the island.

The Miss Christi is classified as a crew boat, a type of working vessel used in the oil industry to carry people and cargo. It was built in 1977 at a small shipyard in Loreauville, Louisiana, and first used in the Gulf of Mexico to serve offshore oil rigs. Later, it was used off the coast of Alaska during the cleanup of the Exxon Valdez oil spill. It was refitted in the early 1990s and used for 18 years to carry Boy Scouts from Marina del Rey to Camp Emerald Bay on the northwest corner of Catalina Island.
The 2012 Maymester group rose to this sudden teaching opportunity as they rose to all their other challenges during their four weeks at the Wrigley Marine Science Center, Heidelberg said, and that experience will stay with them. “These students learned more than what they can get in a traditional class on the main campus,” she said. “They learned both basic knowledge and how to apply that knowledge to real research questions and to teaching.”

Elaine Krebs, one of the students, speaks highly of the hands-on experience and group collaboration in the Maymester course. On the first day, she was on a boat in the Pacific Ocean using a Secchi disk and other instruments that were completely new to her. In the last week, she was applying lecture material to a real-world experiment.

“It didn’t matter that I had only completed my freshman year at USC or that I grew up in the Midwest where there is not a drop of seawater,” Krebs said. “Everyone in the class was learning on the fly. Because of that, the team was forced to work together and help each other out. This built a really strong bond among us, which was invaluable as the topics became more intricate and complicated. I will always remember late one night, after countless flow charts and drawings, when we all finally figured out how our data related and fit together. The feeling of accomplishment after figuring it all out is something I will never forget.”

The undergraduate student group in the 2012 Maymester class on Catalina Island included students with majors in biological sciences, biochemistry, neuroscience and environmental studies. The instructors for the class were Heidelberg and Wiebke Ziebis, Associate Professor of Biological Sciences, assisted by Johanna Holm, a doctoral student in the Heidelberg lab.

“I was very impressed that the course could be so rigorous but enjoyable at the same time,” one student wrote in a course evaluation. “The professors gave the students enough instruction and flexibility to effectively use critical thinking in a research context.”

Heidelberg and others at WMSC noted the exceptional cohesiveness of the 2012 Maymester class was clearly evident when the USC students stepped in to teach a plankton laboratory for a visiting group of 40 high school students.

The students, along with their teachers and chaperones, were visiting the WMSC as part of the statewide MESA (Mathematics Engineering Science Achievement) program, and the group was hosted by the USC Viterbi School of Engineering and escorted by Linda Chilton, Education Program Coordinator with the USC Sea Grant program. During the visit, one of the teachers broke her ankle in a slip while hiking.

“We called Baywatch,” Chilton said. “They recommended an x-ray, which involved an emergency trip across the island to the health clinic in Avalon.”

Chilton was scheduled to lead a plankton lab for the MESA students that night and needed someone to take her place. She asked the Maymester students if they could take over the lab because had seen them during a class on the same subject.

“They had done a plankton lab the night before, and I saw their excitement as they talked to Karla,” Chilton said. “I knew they had the skills and they had the passion. That’s what I always look for whenever I ask someone to work with students—I try to find someone who has a passion for science because it’s contagious—and when I asked them to teach the course, there was no hesitation from the group.”

Chilton showed the Maymester students the supplies they would need to teach the MESA course, and then she drove off with the injured teacher. While they were in Avalon, waiting for the x-rays to be read on the mainland, Chilton received a text message and photos from the MESA teacher (Darin Gray, science coordinator for the MESA Center for Engineering Diversity at USC).

Chilton said, “He wrote ‘everything is going great—and how is our teacher?’”

“I was very impressed that the course could be so rigorous but enjoyable at the same time.”
**Mark Your Calendars**

**FALL 2012**

**Joint Seminar Series in Biodiversity and Environment**

Presented by: USC Dornsife College of Letters, Arts and Sciences, the USC Wrigley Institute, Keck Medical Center of USC and the Natural History Museum of Los Angeles County

- **20 September** - Sharon Strauss, UC Davis (host Sergey Nuzhdin)  
  *The inseparable, interacting effects of community complexity and evolution*  
  3:10pm at USC, 101 Ray R. Irani (RRI) Hall

- **4 October** - Steve Kay, University of Southern California (host John Long)  
  *Architecture and comparative genomics of circadian networks*  
  3:00pm at the Natural History Museum (NHMLAC) Rotunda

- **18 October** - Brad Cardinale, University of Michigan (host Roberta Marinelli)  
  *Biodiversity loss and its impact on humanity*  
  3:10pm at USC, 101 RRI Hall

- **1 November** - Mary Schweitzer, North Carolina State University (host Luis Chiappe)  
  *Dinosaurs and diversity: How can fossils contribute?*  
  3:10pm at NHMLAC Rotunda

- **15 November** - Tony de Tomasso, UC Santa Barbara (host Andrew Gracey)  
  *Natural transplantation and chimerism in the colonial tunicate, Botryllus schlosseri*  
  3:10pm at USC, 101 RRI Hall

For more information and a full list of events, visit wrigley.usc.edu

*To update your contact information please email: jennifdd@usc.edu*