



Chemical Mysteries of the Seafloor

by HMSC Volunteers Annie Thorp and Mike Courtney

The Intrepid Volunteers had the privilege of volunteering on Clare Reimers' recent cruise off the Oregon Coast. Clare, who is a faculty member with the OSU College of Oceanic and Atmospheric Sciences and is based at HMSC, and fellow scientists, Sean Crowe of the University of South Denmark, and Moutusi Roy from OSU, are collaborating in research that focuses on the region of the ocean near the seabed on the continental shelf. The area where we cruised is understudied and Clare's research promises to provide critical data including O_2 (oxygen) consumption and CO_2 (carbon dioxide) production rates at the seafloor that may prove useful in understanding complex issues such as hypoxia, or "dead zones," off the Oregon coast.

The interrelatedness of physical, chemical and biological processes occurring in the ocean is difficult to translate into concepts and language for the "non-science" community. What is amazing is that these ongoing processes on the ocean floor are affecting life as we know it. The benthic zone, which includes the lowest layers of water and the upper layers of sediment at the seafloor,



Clare installing instruments on the IMP

is actually breathing, both taking in and giving off O_2 and CO_2 . On this cruise we were taking samples of water with the CTD (conductivity, temperature, depth) instrument by lowering it and a rosette of bottles close to the seabed. We were also taking sediment samples with a slow corer, an instrument that gradually lowers a tube into the sea floor to bring back an undisturbed sample of 30 to 70 cm of sediment.

Two other instruments, the Eddy Lander and the IMP, were left on the bottom to record O_2 consumption and profiles, and were then retrieved up to 20 hours later. These specialized instruments were developed for the tricky business of monitoring near-bed processes and probing sediments, the sandy bottom proving to be way more difficult to study than mud. The Eddy Lander has a camera that takes photos of the ocean floor, including the



Annie & Mike, Intrepid HMSC volunteers

inquisitive crab populations that can be destructive to sensitive instruments. It also measures the

velocities of wave motions and currents at the seabed, which influence oxygen consumption.

And the fun doesn't stop when aerobic respiration stops. Beneath the surface sediments in deeper layers, anaerobic (without oxygen) respiration by bacteria occurs and these processes convert more organic carbon to carbon dioxide. These transformations are collectively called early diagenesis, and as Clare Reimers explains, "Coastal ecosystems are shaped by the seafloor processes that transport and recycle organic detritus". This research is establishing a baseline on benthic respiration and the waves, currents, and near-bed turbulence that drives respiration in the mid-shelf environment off the Oregon coast. The physical measurements should also prove useful for wave energy studies and are being shared with other researchers at OSU.

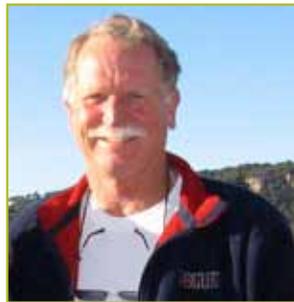


Deploying the Eddy Lander

Of course most oceanographic research would not be possible without a ship, the "moving rolling platform" from which any spot on our vast oceans can be reached. Our special thanks to the wonderful crew of the R/V *Wecoma* who provided the support for this and many other cruises.

Notes from the Director

With fall comes a variety of scientific meetings associated with marine science. I attended the National Association of Marine Laboratories meeting in Groton, Connecticut, which addressed issues and concerns from a



Dr. George Boehlert, HMSC Director

diversity of marine labs around the country. While all marine labs are unique in some way – geographically, scientifically, or in the educational and research programs they support – I am always reminded of the special attributes of the HMSC. With 120 staff from OSU and 180 more from 8 different state and federal agencies, we are clearly the most diverse from an organizational standpoint, and that is a real strength. And formal recognition of that strength was received as the Cooperative Institute for Marine Resource Studies (CIMRS) was renewed through a national competition. Congratulations to Michael Banks and Jessica Waddell for their successful proposal to keep this long-standing OSU-NOAA collaboration funded.

The official opening of NOAA's Marine Operations Center - Pacific also expands the diversity of marine science activities in Newport. This dedication ceremony in August was a major community event, and also brought a very large number of elected officials to Newport – and several visiting the HMSC while here. As I write this note, five NOAA vessels are tied up at the NOAA facility, and many of the new NOAA staff and ship's crews are exploring the range of opportunities our community has to offer.

HMSC's undergraduate research interns continue to distinguish themselves and their mentors through scientific presentations at national and international scientific meetings. Record numbers of presentations from summer 2011 interns include six posters at the Society for the Advancement of Chicanos and Native Americans in Science, one at the Coastal and Estuarine Research Federation meeting in Florida, three at the American Geophysical Union meeting in San Francisco, seven at the Ocean Science Meeting in Salt Lake City, and one each at the Heceta Head Coastal Conference and the Western Society of Naturalists meeting.

Finally, a few words of appreciation for the programs that HMSC's donors make possible. In 2011, we had for the first time two Lavern Weber Visiting Fellows at HMSC in a year. Bronwyn Gillanders from Australia was the first international Weber Fellow, and gave some rather stimulating talks during her visit to HMSC to work in Bryan Black's laboratory. We have also received a generous donation that will stimulate work in Yaquina Bay by OSU's "Marine Team" in the coming year; look for updates in future issues of *Upwelling*. These donations broaden our ability to attract top visiting scientists, and to make the experiential education at HMSC a superb one for our students.



Weber Visiting Fellowship Advances International Collaboration

Dr. Bronwyn Gillanders was HMSC's most recent Lavern Weber Visiting Fellow, visiting HMSC for several weeks in September 2011 all the way from Australia. Dr. Gillanders is a Professor at the School of Earth and Environmental Sciences and Director of the Marine Biology Program at the University of Adelaide. She is a leading expert on otolith (fish ear bone) chemistry and its applications to fish biology and life history.

As a senior scientist with more than 100 professional publications and an internationally recognized research program, Dr. Gillanders provided a unique 'southern hemisphere' research and educational perspective for HMSC scientists and students. She gave a research talk entitled "Stock enhancement projects in the Murray-Darling Basin, Australia: is it just money down the drain?" and a very well-received presentation for the public, "Giant Australian cuttlefish: a globally unique species under threat".

Bryan Black, an OSU-HMSC Associate Professor in the College of Forestry, hosted Dr. Gillanders' visit. In March 2010 he spent several days in Adelaide teaching a workshop on sclerochronology (analysis of growth rings) techniques, helping to complete the first marine otolith growth-increment chronology for the southern hemisphere. Dr. Gillanders' visit allowed further development of research projects and increased collaborative ties between OSU and the University of Adelaide. "Dr. Gillanders' visit has kicked off a number of new projects that will compare fisheries of the North Pacific with those of the South Pacific and Southern Ocean," says Black. "I thank the Weber Visiting Scientist program for the unique opportunity to work directly with Dr. Gillanders here at HMSC to enrich both our research programs."



Dr. Bronwyn Gillanders is shown in the photo with former HMSC Director Dr. Lavern Weber, whose endowment makes the Visiting Fellow Program possible.

Thank you for your support. To become a member of the Friends of HMSC, or for more information, please see <http://hmsc.oregonstate.edu/friends/>

Oregon Sea Grant receives \$2.6 million NSF grant for learning research

Oregon Sea Grant's Free-Choice Learning (FCL) Laboratory has received a 2.6 million dollar, five-year grant from the National Science Foundation to carry out innovative learning research. The FCL Lab is based at the Hatfield Marine Science Visitor Center.

Shawn Rowe, Lab Director and acting Director of Education for Oregon Sea Grant, anticipates that with this new funding the Sea Grant Free-Choice Learning Initiative at HMSC is taking the next step to being a premier research facility for researchers both at OSU and around the country. For the first time, learning researchers will be able to both control exhibit behaviors and access learning data from visitors remotely.

The grant will allow the FCL Lab to develop new tools such as facial recognition, eye-tracking and handheld augmented-reality systems to study visitor behavior. These technologies can also be used to make more exciting and interactive exhibits for visitors. For example, a facial recognition system can work in concert with other technologies to tailor exhibit content to each visitor's knowledge level. Three new exhibits, each serving as a specialized research platform, will be developed over the next 4 years in the Visitor Center. Additionally, HMSC will be hosting up to a dozen visiting scholars over the next 5 years.

by Harrison Baker
Graduate Research Assistant

For more information about the Free-Choice Learning Lab, you can visit the FCL Blog at blogs.oregonstate.edu/freechoicelab/ or follow us on Twitter@FreeChoiceLab.



Shawn Rowe videotaping HMSC visitors to better understand how people interact with living organisms



Marine Investigations Camp 2011

by Tracy Crews
Marine Education Coordinator

This summer, Oregon Sea Grant once again ran day camps at Hatfield Marine Science Center for youth 8 to 18 years old. These camps allowed participants to experience marine science through fieldtrips, hands-on programs, behind-the-scenes tours, and interactions with researchers. Activities included kayaking, tidepooling, building mini-ROVs (Remotely Operated Vehicles), and touring research vessels. Campers came from all over the United States and even Germany and Taiwan. Nine scholarships were provided to local youth through generous donations by the Friends of HMSC and Georgia Pacific.



Dedication of the NOAA Marine Operation Center - Pacific

The new NOAA Marine Operations Center - Pacific in Newport was dedicated on August 20, with strong support from the coastal and statewide community. The dedication was followed by a two-day Open House, allowing approximately 3,500 visitors a unique opportunity to tour the normally secure facility. Dedication ceremony speakers included Governor John Kitzhaber, Senator Ron Wyden, Congressman Kurt Schrader, Newport Mayor Mark McConnell, Port Commission President JoAnn Barton and Port General Manager Don Mann. Representing NOAA was Dr. Jane Lubchenco, NOAA Administrator and OSU Faculty. President Ed Ray represented OSU at the event.



Gov. John Kitzhaber and First Lady Cylvia Hayes took time to tour HMSC while in Newport, and are shown with Renee Bellinger of HMSC's Project CROOS.



Sen. Ron Wyden, Gov. John Kitzhaber and Jane Lubchenco, administrator of the National Oceanic and Atmospheric Administration (NOAA), talk during the dedication ceremony of the new NOAA facility in Newport.



Marine Science Drive sported new banners on light posts, celebrating the diverse organizations that make up our South Beach Marine Science Community.

Volunteer Corner



Itchung Cheung, Academic Program Coordinator at HMSC, became President of Board of Directors at Oregon Coast Council for the Arts in August 2011. Itchung exemplifies the many, many Hatfield faculty, staff and students who volunteer in their communities. A Board member since 2008, Itchung was elected to the position of President by his fellow

board members. "It's a wonderful organization that manages the Newport Performing Arts Center and the Visual Arts Center while at the same time supporting the coastal arts and coastal art communities," said Itchung. "I love being part of OCCA!"

In addition to working in the Visitor Center (VC) interpreting marine science to the general public, many of our volunteers work in a "behind the scenes" capacity. These volunteers may donate their time to help with exhibit development and maintenance, office work, or with animal husbandry. Volunteering since 2002, **Nancy Edwards** took on a large project this past summer; working to update all VC volunteer emergency and general contact information. Nancy also added new DVDs to the VC film catalog. She is now back in Arizona where she spends each winter but will return to Newport next summer. Thank you Nancy for all of the time and energy you've contributed over the past few months (and years)!



A program designed to train early career scientists in how to lead expeditionary research programs at sea was conducted by OSU-HMSC faculty member Clare Reimers and colleagues from the **University-National Oceanographic Laboratory System (UNOLS)**, with support from OSU Ship Operations. Each of two sessions began with an informational session ashore followed by a research cruise on the R/V *Wecoma*, the UNOLS vessel hosted by OSU in Newport. The program's intention was to "demystify" the process of ship operations, and included the history, purpose and structure of UNOLS and the UNOLS Fleet, which is managed by and for the university research community. It also covered logistics such as preparing proposals and ship time requests. Other highlights were a presentation on the difference in mission between the NOAA and UNOLS fleets, and the "Responsibilities, common mistakes and problems encountered by a chief scientist" at sea. Organizers of the successful training program were Clare Reimers (see story, page 1), Pat Wheeler, and Daryl Swensen, all of whom volunteer their time to make the UNOLS fleet possible.



Although HMSC, as a marine lab, relies on access to seawater and the ocean, our coastal location is not without risk. A **Tsunami Evacuation Drill** was conducted on October 5 for Newport's South Beach Peninsula, home to HMSC and other marine science and public-serving organizations whose facilities are in the inundation zone. Almost 200 participants walked to HMSC's nearest evacuation point, the hill just west of the entrance to the Yaquina Bay Bridge, which at 85 feet high was recently dubbed "Safe Haven Hill". A team of community partners led by Newport Police assisted by briefly closing Highway 101 so "evacuees" could cross safely to access the trail to the top of the hill. Preparations continue for the possibility of a Cascadia earthquake off the coast of Oregon, which is expected to produce tsunami inundation similar to the devastating March 2011 earthquake in Japan.

Honor Roll

Chelle Boswell, an employee in HMSC's business office, was presented with the ALL STAR award at the OSU Finance and Administration's annual picnic in July 2011. Chelle was recognized with their highest

award for her actions and achievements exemplifying the department's core values of Accountability, Diversity, Integrity,

Respect and Social Responsibility. Those working with Chelle know that this prestigious honor is well-deserved. Congratulations!



The National Weather Service recently honored **Clay Creech** for 35 years of service maintaining the official weather station at HMSC.

Clay received his 35-year pin at a ceremony on August 25 on the HMSC Campus, and is shown in the photo (third from left) with (l to r) Michael Banks, Director of the OSU-NOAA Cooperative Institute for Marine Resources Studies, former HMSC Director Lavern Weber, and Gerald Macke of the National Weather Service. The photo was taken by Janet Webster, Director of the OSU Guin Library, which hosts the weather station, and many others from the HMSC Community also attended. Clay's weather page is the most visited page of the HMSC website! Go to hmsc.oregonstate.edu and click on "Weather".



HMSC Academic Program News

What do you get when you combine scientific calculators, sand and sea?

What better way to learn linear algebra, vector calculus and differential equations than at the beach? This fall marks the third year that OSU's College of Oceanic & Atmospheric Sciences (COAS) has offered their "Math Boot Camp" at HMSC. COAS Physical Oceanographer Bill Smyth developed the course concept to meet the needs of incoming students in the COAS program before the traditional OSU Fall term. "OC599 - Math on the Beach: A workshop on basic mathematical methods for the

natural sciences" held on the Oregon Coast is a 9-day residential program combining an intensive review of applied mathematics with scientific lectures and field trips exploring the coastal environment. This year, 10 students housed at HMSC were led by COAS Professor Dudley Chelton through mornings of linear algebra, vector calculus and differential equations and afternoons full of field excursion exploring the Oregon Coast's currents, waves, forests, beaches and the Cascadia subduction zone.



University Bridge Programs Connect HMSC with OSU

At the beginning of OSU's fall term, HMSC experiences a rush of student group visits from new students to student ambassadors. Many of these visits are associated with **CONNECT Week**, OSU's orientation week prior to the start of classes. In addition to the new students enrolled in courses at HMSC for the Fisheries & Wildlife Fall Term, university summer "bridge" groups from programs such as College Assistance Migrant Program (CAMP) and the Louis Stokes Alliance for Minority Participation Bridge Program (LSAMP) visit to learn more about



HMSC's Academic Programs. More and more, OSU programs and students are visiting HMSC as part of their orientation and education about the many opportunities in research, education and outreach here at HMSC. Many of these outreach, recruitment and retention programs learn and inform current, new and future OSU students, staff and faculty about the academic and research opportunities that exist at their HMSC.

HMSC graduate student Alana Alexander shares her cetacean genetics research with LSAMP students.

Student Research: A Cetacean Adventure In French Polynesia

by Renee Albertson, OSU Graduate Student

As an OSU graduate student in HMSC's Marine Mammal Institute, I am investigating the worldwide population structure and differentiation in the rough-toothed dolphin (*Steno bredanensis*), including a unique collection from insular populations around islands of the South Pacific. I embarked on this month-long project in October, along with my collaborators, Michael Poole, Daniel Webster, Pamela Carzon, and volunteer Jim Sumich, to collect biopsy skin samples from this little studied species in the Society Islands of French Polynesia.

In addition to valuable genetic information contained in the biopsy samples, we are also collecting photographs of the dorsal fins. Dolphins can be identified by unique nicks and scars on their dorsal fins. Our research team compares the new dorsal fin photos with our French Polynesia photo catalog looking for resights to determine where these individuals may have been seen previously. Combined with the genetic data, we will be able to ascertain a lot about habitat utilization, social structure and movement around the Leeward Islands and within French Polynesia. This provides government agencies with valuable information on how to manage this species, which faces ever-increasing anthropogenic threats.

The challenge of this project is covering the vast habitat range. These dolphins inhabit deep waters, generally between 1,000 to 2,000 meters, but sometimes are seen in depths of only 200 meters, and even observed in shallow waters near the reef. So the survey area covers transects between 200 m from the reef to 6 km offshore. That's a lot of water, and it sometimes feels like our team is looking for a needle in a

haystack. To make it more complicated, there is very little data on this species in this or other areas of French Polynesia, so we are relying on current sightings from fishermen and boaters, as well as sighting information from previous studies. It may seem a daunting task, but that does not deter us from continuing our efforts to learn more about this elusive species.

We have now doubled our sample size during this project and that's exciting! By the time this newsletter goes to print, I'll be back in the lab in Newport, but to read about our adventures, check out our blog at: http://mmi.oregonstate.edu/french_polynesia. This work is made possible in part by the Pew Trust, Mamie Markham Research Award and Dolphin and Whale Watch Expeditions.



Department of Fisheries and Wildlife Staying Connected at HMSC



A highlight every year at the end of OSU's CONNECT week is the OSU Department of Fisheries and Wildlife's annual visit and introduction to HMSC. In addition to exploring the mudflats with John Chapman, this year students boarded the R/V *Wecoma* to

tour the research vessel with the ship's crew. Nearly forty F&W undergrads heard from FW faculty and interns about the research, courses and internships at HMSC. During the walking tour of HMSC, students had the opportunity to hear Markus Horning (FW faculty and Marine Mammal Institute) explain his research using life history tags to better understand Weddell seals. The group also received student perspectives from two undergraduates, Dylan McDowell and Mee-ya Monin, who shared their internship experience at HMSC. In fact, Mee-ya is still in hers and is in Antarctica right now. You can follow her blog at: <http://blogs.oregonstate.edu/hailingfrozenthoughts/>

OSU Fisheries & Wildlife undergrads learn about current research on marine invasive species with HMSC's Dr. John Chapman.

OSU undergrad Mee-ya Monin (second from left) is blogging from Antarctica about her research experience with Weddell seals.





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Upwelling is produced and distributed 3 times a year to the Friends of HMSC membership. Your feedback is welcome.
(email: maryann.bozza@oregonstate.edu)

First successful forecast of an undersea volcano

Bill Chadwick, a geologist at HMSC, and Scott Nooner, of Columbia University, have been monitoring Axial Seamount, an undersea volcano located about 250 miles off the Oregon coast for more than a decade. They recently discovered a new eruption on an expedition this summer aboard the R/V *Atlantis*. Using Jason (see photo), a remotely operated robotic vehicle (ROV), Chadwick, Nooner and HMSC research assistants Susan Merle, Matt Fowler, and Leigh Evans discovered a new lava flow on the seafloor that was not present a year ago. Instruments recovered during the cruise showed that the eruption took place on April 6 of this year.

“It’s funny,” Chadwick said. “When we first arrived on the seafloor, we thought we were in the wrong place because it looked so completely different. We couldn’t find our markers or monitoring instruments or other distinctive features on the bottom. Once we figured out that an eruption had happened, we were pretty excited.”

What makes the event so intriguing is that these scientists had forecast the eruption starting five years ago – the first successful forecast of an undersea volcano. A 2006 paper in the *Journal of Volcanology and Geothermal Research* forecasted that Axial would erupt before the year 2014.

Axial Seamount is one of the most active and intensely studied seamounts in the world. It last erupted in 1998 and Chadwick and his NOAA Vents Program colleagues have monitored it ever since. Their forecast was based on a time-series of seafloor pressure measurements that indicated the volcano was gradually



inflating at the rate of 15 centimeters (six inches) per year, indicating that magma was rising and accumulating under the volcano summit.

During the 1998 eruption, the floor of the caldera suddenly subsided or deflated by 3.2 meters (10.5 feet) when magma was removed from underground to erupt at the surface. The scientists estimated that the volcano would be ready to erupt again when re-inflation pushed the caldera floor back up to its 1998 level.

Bill Chadwick is part of the Cooperative Institute for Marine Resource Studies – a joint NOAA/Oregon State University institute based at HMSC. Their expedition was jointly funded by the National Oceanic and Atmospheric Administration and the National Science Foundation. For more information, see:

http://www.pmel.noaa.gov/vents/axial_site.html