Oil Spill Research Abounds at Dept. of Marine Science

On April 20, 2010, the Deepwater Horizon oil rig exploded in the Gulf of Mexico. Within the past year, researchers at the Southern Miss Department of Marine Science have been trying to determine how the Gulf of Mexico may be impacted from the event.

Charlotte Brunner, Kevin Yeager, Laodong Guo, Kevin Briggs and others have been studying the effect of the oil spill on benthic animals. The group has been looking at the macrofauna, multicellular animals larger than medium sand, and benthic foraminifera, a group of silt to fine-sand size, single-celled animals, both of which live mostly in the top 10 centimeters of sediment. Hundreds of samples were collected in 2010, both during and after the spill, from marshes, the Mississippi and Chandeleur Sounds, and the Mississippi continental margin to a depth of 2,000 meters, including near the Macondo well head. This effort will be repeated in 2011 to determine if the fauna shows significant changes.

In a different study, Guo and other researchers used ultraviolet-visible and 3-D fluorescence spectroscopy and PARAFAC modeling for fingerprinting oil to determine oil distribution and transport in the Gulf of Mexico. The researchers found that changes in fluorescence component ratios can be used to track the degradation status and the fate and transport of oil in marine environments.

Scott Milroy’s research concerns the extent to which petroleum hydrocarbons from BP crude, including volatile aliphatic hydrocarbons and the more toxic polycyclic aromatic hydrocarbons (PAHs), are being accumulated in the tissues of organisms at all trophic levels within the coastal food web and how these toxic hydrocarbons might affect ecosystem function in the Mississippi Sound. These data have been used to inform marine resource managers of the potential risks to seafood safety and will also be used develop an oil spill - food web interaction model to understand how oil-related toxicants enter the coastal marine food web at various trophic levels and to predict the ultimate fate of toxic hydrocarbons in the coastal marine ecosystem.

Alan Shiller and his research group have been looking at chemical relationships in the submerged oil plumes from the spill. The researchers have looked at metals, nutrients, oxygen, and PAHs. The reasons for examining these chemicals are varied. As a highly toxic group of compounds, the PAHs serve as important indicators of the oil contamination. Some metals are enriched in crude oil and this too could have toxic effects. As the oil gets broken down by micro-organisms, distributions of dissolved oxygen and plant nutrients should be affected. Much of the field work has been performed by graduate student DongJoo Joung who has participated in three research cruises to the spill area.
This past year has been unprecedented for the Department of Marine Science in numerous ways. The most dramatic example of this was the Deepwater Horizon oil spill. Our faculty and students have been at the forefront of the research response to this catastrophic event and were among the first academic research teams to reach the site of the spill and document its impacts. DMS researchers have continued this work with the support of nearly $1 million in funding from sources, including BP, through the Northern Gulf Institute and NSF Rapid Response awards. Additionally, DMS faculty were sought after to participate in numerous workshops and symposia that addressed aspects of the response effort and assessment of impacts of the oil spill.

In addition to oil spill research, the department continued to be active in numerous other research activities and generated a record $8.2 million in external funding in 2010. This includes work in coastal ocean observations and modeling, the development of new biochemical sensors, characterizing the dynamics of nutrients and ocean acidification in coastal waters, advancements in ocean exploration technology, and a variety of other work.

Another important milestone for our program has been the occupation of the new Oceanographic Support Facility. This multifunctional building is already being heavily used for a variety of projects and has greatly enhanced the capabilities of our program to provide support for oceanographic operations. Having this capability truly elevates our program to being one of the premier marine facilities in the Gulf Coast region.

Our primary mission remains that of graduate and undergraduate education in marine science, and our research programs and facilities provide an ideal experiential learning environment for our students (see Student Profile).

The Hydrographic Science degree program has been particularly productive with the number of graduates reaching 116 since the program’s inception in 1999. All of our graduates, from hydrographic science to marine science, continue to distinguish themselves professionally as highlighted in the alumni interview with Dr. Ingrid Garcia-Hansen Honkala. The success of our alumni is a true testament to the quality of our program.

It is with mixed feelings that I write this last letter as Chair of the Department of Marine Science, as I will be retiring from The University of Southern Mississippi to take a position as Dean of the School for Marine Science and Technology at the University of Massachusetts – Dartmouth. It has been a wonderful experience to be a part of this program for the last 23 years. I leave DMS in very capable hands and know that it has a bright future as a leading marine science program in the Gulf Coast region and beyond.

Photo taken by Dr. Lohrenz while surveying the Deepwater Horizon oil spill site
Asper Uses Gliders to Study Phytoplankton Bloom in Antarctica

Numerous approaches have been used to observe the rapid development of the annual phytoplankton bloom in the Ross Sea in Antarctica. In the Austral Spring of 2010, Dr. Vernon Asper was part of a group that deployed two iRobot Seagliders equipped with fluorometers, oxygen sensors and CTDs in order to obtain data on this phenomenon over the entire duration of the bloom.

The team overcame numerous challenges, including magnetic compass calibration and alignment, cold surface temperatures, ice cover, potential conflicts with megafauna, and the logistical constraints associated with the remote location. The compass calibration was performed using a GPS-based heading reference system that was installed in place of the glider’s vertical stabilizer. The glider was then transported to the sea ice, where it was positioned in numerous pitch, roll, and heading combinations so that a table calibrating the GPS-derived true heading to the glider-calculated true heading could be produced. This table was verified and loaded into the glider.

The gliders were launched at the seaward edge of the shore-fast sea ice in both cases. Glider 502 was deployed on November 22, 2010, in McMurdo Sound through a very thin layer of “grease” ice. This location was not ideal and required the glider to make a transit of over 160 kilometers, where the final 40+ kilometers were under dense pack ice. Glider 503 was deployed a week later on the north side of Ross Island through a hole that was created by and shared with several minke whales and which was several kilometers from the open water of the polynya.

Both gliders were tracked remotely using positions relayed to the Applied Physics Lab at the University of Washington using an iridium phone. The RVIB Nathaniel B. Palmer recovered Glider 502 after 59 days and Glider 503 after 63 days having covered 1,342 and 1,671 kilometers over the ground, respectively. Data from these deployments will be used to model and better understand the dynamics of this important phytoplankton bloom.

MTS Chapter Makes ROV-in-a-Bag a Success at St. Stanislaus

Department of Marine Science students Ryan Vandermeulen, Matt Dornback, Amy Glover, Andreas Moshogianis, Zhengzhen Zhou, and Sarah Epps all participated in the ROV-in-a-bag event this past November at St. Stanislaus High School in Bay St. Louis. Organized and led by Vandermeulen and Dornback, the students gave a presentation to 10 students from the St. Stanislaus Robotics Team on remotely operated vehicles, or ROVs. After the presentation, the St. Stanislaus students were introduced to the building materials and showed enthusiasm for the project. When it was time for action, they planned, organized, and executed the building of their ROVs with incredible efficiency.

The university’s student chapter of the Marine Technology Society (MTS), which has wanted to participate in more community outreach projects, was given this ability when former Student Chair Virgilio Masionet and current Parent Chapter Liaison Laurie Jugan helped obtain five ROV-in-a-bag kits, which were donated by Drew Michelle. NASA agreed to offer the program as an optional add-on to visiting school groups. In addition, Dr. Vernon Asper donated a small pool to the MTS chapter so the program could be executed on-site and close to classrooms.

The chapter’s collaboration with NASA will ensure the continuation of the program, but the DMS students will continue to reach out to interested schools and try to visit them with the program. In addition to helping younger students, the chapter’s membership hopes to assist its own members by organizing several field trips to oceanographic agencies located at Stennis Space Center (NOAA, Naval Oceanographic Command, Naval Research Lab, NASA, USGS, etc.) where they can see the applied sciences at work and network with the professional work force.


GRANTS

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The University of Southern Mississippi recognized 11 students from hydrographic science master’s degree program on July 30, 2010, during a ceremony at Stennis Space Center. The ceremony was presided over by Rear Admiral Ken Barbor, USN (Ret.) with remarks by Southern Miss President Martha Saunders, Vice President for Research Denis Wiesenburg, and Rear Admiral Jonathan White of the U.S. Navy.

In addition to a master of science degree in hydrographic science, each student received the Category A Recognition Certificate established by the International Board for Standards of Competence for Hydrographic Surveyors and Nautical Cartographers. Philip Sparr of the National Oceanic and Atmospheric Administration (NOAA) was awarded the Hydrographer of the Navy Education Award by RDML White.

Since the first commencement in 2000, a total of 116 students, including this class, have completed the program. The 2010 class included students from four foreign nations: Egypt, the Netherlands, Thailand, Trinidad & Tobago and the U.S. All students completed the 36-hour graduate program which culminated with a 6-week summer survey project where all students had to demonstrate their proficiency in all aspects of hydrographic science.

While the summer survey projects were originally planned to be conducted off Pass Christian and Bay St. Louis, concern over operational restrictions due to the BP oil spill required a change in locale. The students divided themselves into two independent teams and surveyed areas in the Tchefuncte River near Madisonville, La., and the Pearl River near Stennis Space Center. For their survey project, each team produced a highly detailed Report of Survey, high-resolution bathymetric surfaces, a side-scan-sonar mosaic, a sonar contact list, a paper nautical chart, and an Electronic Navigational Chart (ENC).

Both teams successfully completed all data collection tasks. After the completion of these tasks and the required deliverable products, the members of both teams successfully defended their findings before the hydrographic faculty committee for the oral comprehensive examination. The faculty at DMS wish the 2010 graduates success in their hydrographic careers.
Andrea Braatz has always kept herself busy. While working on her undergraduate degree from the University of Wisconsin Stevens Point’s College of Natural Resources, she double majored in natural resource management and biology. To accompany her majors, she minored in environmental law enforcement and natural science. In fall 2008, Braatz came to the Department of Marine Science to earn her master’s degree in Marine Science. Her primary interests in this field included atmosphere-climate interactions and climate change issues.

“My current work involves air-sea CO₂ flux within the NW Mississippi Bight region,” said Braatz. “The ocean is an important sink for increasing anthropogenic inputs of CO₂ to the atmosphere. Due to higher variability, the capacity for the coastal ocean to uptake atmospheric CO₂ is not as well characterized as that of the open ocean. Quantifying air-sea CO₂ flux in coastal waters is critical for accurate global carbon budgeting.”

When she completes her master’s degree, Braatz plans to pursue a career in oceanography, environmental science or both. “Ideally, I would like to continue working with processing buoy data, atmospheric and oceanic interactions and climate change issues,” added Braatz. “Carbon dioxide exchange between the land and the atmosphere also interests me. My family and I are excited about moving on to the next chapter of our lives in a new, and hopefully exciting, location.”

Outside of university life, Braatz likes to hike, swim, camp, canoe or watch wildlife. In addition to outdoor activities, Braatz and her daughter volunteer at the local animal shelter several times a week. Their family includes three cats and a guinea pig.
Q & A With Alumnus

Spotlight on Southern Miss Alumnus, Ingrid Garcia-Hansen Honkala

What is your current area of research/work?

I currently work as an oceanographer with the Marine Optics group of the Naval Oceanographic Office (NAVOCEANO). I serve as an analyst and subject matter expert on optics data collection, data processing and production to support the mission of the warfighter. I put a great level of detail and creativity in the elaboration of oceanographic products. As a result these products are easy to understand and manipulate by the client.

What area of Marine Science did you study at Southern Miss?

While doing my Ph.D. at DMS, I had an emphasis in biological oceanography, because this was the area of research I had been working on for several years prior to becoming a student at Southern Miss.

Did you like the size of the program?

It was good for me. I always have been very dedicated to my work so I think that it is always up to you to reach your goals no matter how many people are around you.

How did your experience in graduate school prepare you for your current work?

The program helped me to understand oceanographic processes in a greater level of detail. I was able to integrate a lot better the different areas of oceanography (physics, chemistry, biology and geology) and use these interrelationships to explain the biological processes observed in the ocean. I have learned that biology can not be explained by itself. You have to put together the whole picture to comprehend life in the sea.

Were there specific classes or professors that informed which direction your research went?

I always knew that I wanted to continue working with the research work I was doing back in Colombia (the effects of climate variability on the phytoplankton communities) when I was the manager of the Marine Biology and Ecology Department of the Naval Oceanographic Research Center for the Pacific Coast of Colombia. The classes, especially the professors, guided me in how to handle and analyze the enormous amount of oceanographic and meteorological data that this research center had collected for the past 15 years. The methods and analysis used in my dissertation have been a great success, since they have been utilized by the scientific community from various countries in South America.

DMS Student Awarded Research Fellowship from NASA

Ryan A. Vandermeulen, a second year graduate student in the biological oceanography program at DMS, was awarded the prestigious Graduate Student Research Program (GSRP) Fellowship from NASA in June. The fellowship includes student salary, travel to meetings and commodities for two years - a total budget of $60,000.

The NASA grant, titled “Nutrient Criteria and Primary Productivity Driving Ocean Color Distribution Observed by Remote Sensing in the Mississippi Bight,” aims at bridging MODIS satellite data products with in-situ measurements of primary productivity and respiration. “Solar radiation is driving ocean primary productivity and we can measure Photosynthetically Active Radiance (PAR) by satellite as well as by surface in-situ observations,” Vandermeulen says. “This commonality will help us generate a link between ocean production, respiration and remote sensing.” Vandermeulen, from Mississippi, joined the DMS graduate program at Stennis Space Center in August 2009. Part of the GSRP fellowship field sampling is tied in with the ongoing Northern Gulf Institute initiative to DMS, with lead PI Dr. Stephan Howden. The fellowship is under the auspice of Howden, Dr. Kjell Gundersen, DMS student advisor, and Dr. Bruce Spiering, NASA technical advisor.
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