

## College of Marine Science

### Dean's Annual Report for 2011

April 18, 2012

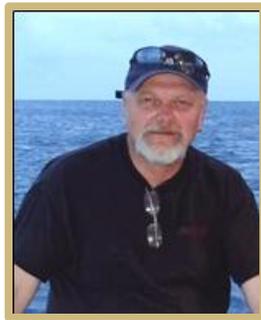
As I move into my second year as Dean, I am proud that we continue to be a global leader in applying science to society's needs through research, service and training of future scientists. Join me in reflecting on the results of our programs and the progress we've made in the past academic year.

#### People:

Four new faculty members, Cameron Ainsworth, Steve Murawski, Amelia Shevenell and Chris Stallings, have joined the College this academic year. These new additions join a strong, talented group of researchers and teachers.



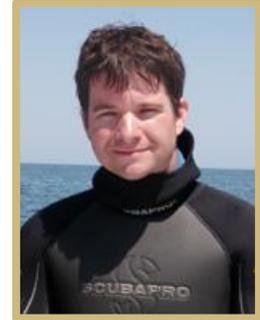
Cameron Ainsworth  
Biological Oceanography



Steve Murawski  
Biological Oceanography



Amelia Shevenell  
Geological Oceanography



Chris Stallings  
Biological Oceanography

The College would like to thank Dr. Edward Van Vleet, Director of Academic Affairs/Professor Chemical Oceanography, and Bob Jolley, Coordinator, for their years of dedication and service at USF.

Congratulations on your retirement! Though it is difficult to imagine anyone else in the role of Director of the Graduate Program, David Naar has taken up the challenge. Al Hine has stepped down as Associate Dean to return to the joy of science, passing the baton to Gary Mitchum.

#### Research Highlights:

In fiscal year 2011, faculty and researchers at the college brought in over \$12 million in research funding and published over 95 scientific articles. It is impossible to describe the full breadth of research and education efforts currently underway at the college to explore, understand, and preserve the global ocean, however, I've picked out a few highlights.

**Changing Ocean Chemistry:** Bob Byrne and others ventured into the Beaufort Sea in the western Arctic Ocean on the *US Coast Guard Cutter Healy* in October 2011. The title of the resulting paper, "Storm-induced upwelling of high  $p\text{CO}_2$  waters onto the continental shelf of the western Arctic Ocean" (Mathis et al., 2012), provides a clue that perhaps October is not the best time for research in the Arctic! Byrne found that carbon system in this region is undergoing a rapid transition as sea ice extent and thickness decline. During the cruise, persistent wind-driven upwelling of cold, salty, aragonite-undersaturated water occurred in open water along the continental shelf. A single 10-day event led to the outgassing of 0.18–0.54 Tg-C and caused aragonite undersaturations throughout the water column over the shelf. Assuming four such upwelling events each year, the annual flux to the atmosphere (0.72–2.16 Tg-C) would be similar to the total annual sink of  $\text{CO}_2$  in the Beaufort Sea from primary production. These upwelling events have likely been exacerbated in recent years by declining sea ice cover and changing atmospheric conditions in the region, and could have significant impacts on regional carbon budgets. Although the cruise ended in late October, some aspects of the Arctic experience persisted for months more. Since the *Healy* was needed for ice-breaking operations during a late season fuel delivery to Nome Alaska, nearly all of the USF equipment used on the cruise was still heading north in late January. Researchers and equipment have been reunited, and the next Arctic adventure for CMS personnel will take place near the Mackenzie River delta in October 2012.

*Viruses! Just when you thought it was safe to go back to the water:* Viruses are the most abundant biological entities in the oceans, with as many as ten million viruses in a single milliliter of seawater! Mya Breitbart's laboratory has been focused on examining the spatial and temporal variability of viruses in the oceans, as well as discovering completely new groups of single-stranded DNA viruses. The Breitbart lab, in collaboration with an international team of researchers, recently developed a new genetic marker for studying viral diversity throughout the global oceans (Goldsmith et al., 2011). Breitbart's group has also been intensively studying the viral communities in the Sargasso Sea through regular sampling near Bermuda. In collaboration with Craig Carlson at the University of California Santa Barbara and Rachel Parsons and Michael Lomas at the Bermuda Institute of Ocean Sciences, her lab recently published a decade-long time series of viral abundance at the Bermuda Atlantic Time-series Study Site (Parsons et al., 2012). These data show strikingly repeatable seasonal patterns in viral abundance that are linked to water column stratification and the abundance of a major lineage of cyanobacteria. In addition, Breitbart's group published the first study to examine the biogeography and diversity of single-stranded marine phages, a group of viruses that were only recently discovered in the oceans (Tucker et al., 2011). This manuscript was one of the Top 10 papers in the ISME Journal. Finally, Breitbart published an invited, comprehensive review about marine viruses in Annual Review of Marine Science (Breitbart, 2012).

*Gene Therapy in the Reef Environment:* Changing climate and other environmental conditions are leading to degradation and destruction of coral reefs in Florida and around the world. Scientists in an international collaboration from USF/CMS (John Paul, Lauren McDaniel), Mote Marine Laboratory (Kimberly Ritchie) and King Abdulla University of Science and Technology (KAUST) (Christian Voolstra) are creating a new field of research that could have tremendous application for reef restoration and sustainability: Gene Therapy for Corals. In biomedicine, certain diseases can be effectively treated via gene therapy. A similar process is envisioned in the coral reef environment whereby genes are delivered in viral vectors to make the reefs more resilient. Sound farfetched? Paul and his group have already had success in gene delivery to marine microbial populations using purified Gene Transfer Agents (McDaniel et al., 2010). If successful, their research has the potential to provide coral reef resource managers with a powerful new tool to augment coral recovery and colonization.

*Greenland Ice Sheet Melting:* Dramatic changes in climate are impacting Greenland, where melting of the ice sheet is a major contributor to global mean sea level rise. Scientists at USF/CMS led by Don Chambers are using data from the United States/German satellite mission - Gravity Recovery and Climate Experiment (GRACE) - to make precise observations mass changes of the Greenland ice sheet (Wouters et al., 2008). Calculations suggest that Greenland's contribution to sea level rise has nearly doubled in the decade. This accelerating rate of melting is confirmed by independent analysis of the rate of crustal uplift (Jiang et al., 2010) by USF scientist Tim Dixon in the Geology Department, using high-precision GPS measurements (the continent is losing mass so quickly that its rocky margins are rebounding upward at an accelerating rate). What is less certain is the cause of the acceleration, whether it will continue, and implications for the long-term health of the ice sheet. An interdisciplinary research effort (Chambers, Hu, Dixon, and others) is underway that will combine observations of marginal ice zones, nearby crustal uplift, and ocean conditions in and near the fiords where outlet glaciers interact with warming water to better understand the causes and consequences of this rapid ice melting.

*Deepwater Horizon Oil Spill:* CMS researchers were at the forefront of tracking the 2010 Deepwater Horizon oil spill (Bob Weisberg, Chuanmin Hu, Frank Muller-Karger), determining its extent in the subsurface (Ben Flower, David Hollander, Paula Coble, Ernst Peebles), and determining the toxicity and ecosystem impacts (Jose Torres, John Paul) and continue to play a major role in studying the longer-term environmental impacts. A collaboration of several CMS groups led to a cover story published by AGU's Geophysical Research Letters (Hu et al., 2011) later highlighted by AGU's EOS as a "research spotlight." The research combined remote sensing observations, numerical models, and field measurements to document ocean changes after the spill. Frank Muller-Karger participated in a collaboration between USF, NOAA, NASA, and ROFFS Inc. to examine the overlap between Bluefin Tuna spawning habitat and surface oil in the northern Gulf during the spill using satellite-derived estimates of oil coverage and spawning habitat models. Overall, less than 10% of BFT spawning habitat was predicted to have been covered by surface oil, and less than 12% of larval BFT were predicted to have been located within contaminated waters in the northern GOM.

CMS scientists (Cam Ainsworth, Kendra Daly, Ben Flower, Teresa Greely, David Hollander, Chuanmin Hu, Steve Murawski-PI, John Paul, Ernst Peebles and John Walsh) received \$11M through the Gulf of Mexico Research Initiative (GRI; <http://www.gulfresearchinitiative.org>) as lead institution for one of eight funded consortia. Research by our consortium, *Center for Integrated Modeling and Analysis of Gulf Ecosystems (C-IMAGE)*, <http://cimage.rc.usf.edu>) will focus on assessing ecosystem impact of the spill by 1) improving models of the physics and chemistry of multi-phase plume dynamics, 2) integrating these plume models with circulation and oil fate models, and 3) investigating impacts of the spill using data collected from sediments, waters, and biota from the Gulf of Mexico. C-IMAGE has pulled together a multi-disciplinary team, including scientists from Hamburg University of Technology (Germany), Wageningen University (Netherlands), University of Calgary (Canada), Eckerd College, Florida Institution of Oceanography, Mote Marine Laboratory, Scripps Institution of Oceanography Texas A&M University, University of South Alabama, University of Miami, University of Pennsylvania, and University of West Florida. Other CMS faculty and scientists (Ben Flower, Al Hine, David Hollander, Stan Locker, and Bob Weisberg) were funded through another GRI funded consortia led by FSU (DEEP-C) that focuses on deep to shallow transport within the DeSoto Canyon near the wellhead. This research is just starting, and it will be several years at least before we know the full long term ecological impacts of the spill. Important initial findings include observations of rapid accumulation of oil contaminated sediments (dirty blizzard), toxic compound accumulation in zooplankton (an important food source for fish at the bottom of the food chain), and elevated fish disease in the area of the spill.

USF/CMS has joined with the National Marine Fisheries Service and the Florida Wildlife Research Institute and the commercial fishing industry to investigate a surge in anecdotal reports of fish suffering from strange lesions, discoloration and fin rot since the oil spill. Working with commercial fishing fleets over the summer, USF scientists led by Florida Institute of Oceanography Director Bill Hogarth and CMS Biological Oceanographer and fisheries expert Steve Murawski have gathered thousands of fish from the Gulf using chartered fishing vessels to document the mysterious ailments and investigate potential causes. Samples of bile, muscle and liver were taken for analysis of polycyclic aromatic hydrocarbons (PAHs, the toxic and carcinogenic constituents of oil). Histopathology samples were taken from livers and other organs. Trace metals in fish ear bones (otoliths) are being analyzed by Ernst Peebles to provide the timing of exposure to oil and other contaminants. Results confirm the higher rate of external skin ulcers in the spill zone, as compared with west Florida, with tilefish, southern hake, yellowedge grouper and red snapper having the highest rates of infection. This research will continue this summer with support from the C-IMAGE consortium and other sources.

*Center for Ocean Technology (COT):* Speaking of disaster response, COT Research Associate Karen Dreger was selected as a member of the former USF Engineering Professor Robin Murphy's CRASAR – Roboticians without Borders team that went to Japan in response to the 2011 tsunami and nuclear disaster at Fukushima. Karen and the team used Remote Operated Vehicles, including one of COT's, to inspect several northern ports for debris and human remains. Based on this work one of the ports opened up immediately so that fishermen and other users could get back to work. In addition to the initial media attention, a paper she co-authored (Murphy et al., 2011) about their deployment in Japan was a finalist for best paper at the IEEE Safety, Security Rescue Robot Conference last November. The Center for Ocean Technology and USF were also listed in the acknowledgements section in the February 2012 issue of Sea Technology in the article about ROVs used in Japan by fellow CRASAR team member J. Rodocker.

COT engineer Chad Lembke and other COT staff have been busy with glider deployments over the last year. The first was conducted last fall as a collaborative effort with Mote Marine Lab. That 28 day deployment investigated a red tide event in the Gulf waters west of Charlotte Harbor. The second deployment is still underway and is expected to be the longest deployment to date at 33 days. The deployments can be tracked at <http://ooma.marine.usf.edu/CROW/>.

### **Other Research Highlights:**

Through the State Boost award program, the College of Marine Science was given a one-time only award of \$150,000 for Interdisciplinary Research Grants (IRG) to support proof of concept interdisciplinary research between CMS and the other USF colleges and partners (FWRI, USGS, NOAA, SRI, Mote). A call for proposals was distributed in March 2011 with an April 30th deadline. A total of eleven proposals were

submitted. The quality and breadth of proposed collaborations was impressive. Proposals were ranked by a faculty committee and awards were announced on May 24<sup>th</sup>. Four proposals were fully or partially funded. Funds will be provided for seed research between CMS faculty and the USGS (Flower & Moyer), Mote (Weisberg & Kirkpatrick; Paul & Ritchie), the College of Medicine (Breitbart & Dishaw). Various subaccounts for the award have been established and distribution of funds is in progress.

CMS faculty Frank Muller-Karger leads the international CARIACO Ocean Time-Series program, supported by NSF and Venezuela's FONACIT/MCT to investigate major ecosystem changes in the southern Caribbean Sea. Observations over the past 16+ years show that the Caribbean Sea has warmed, and Trade Wind intensity has decreased, leading to corresponding decreases in ocean productivity, and severe impacts on the southeastern Caribbean sardine fishery (Lorenzoni et al., 2011 and 2012). Muller-Karger is also involved in a collaboration between ROFFS Inc., USF, NOAA, and NASA to investigate larvae of highly migratory fish in the Gulf of Mexico, including Bluefin tuna (*Thunnus thynnus*), little tunny (*Euthynnus alleteratus*), and *Auxis* spp. They find that these larvae preferentially locate within the boundaries of anticyclonic (clockwise) features and within Gulf "common waters".

Many other CMS faculty are involved in fisheries, coral reef, and sustainability-related research. For example Chris Stallings was awarded a NOAA grant to estimate the population size, age structure and reproductive state of the goliath grouper, a critically endangered species in Florida. USF scientists, including graduate student Inia Soto-Ramos, and various institutions in Mexico examined a very large red tide event that occurred off the coast of Mexico in a rapid-response fashion, demonstrating technologies and know-how transfer that highlighted bilateral research efforts (Soto-Ramos et al., 2012).

Chuanmin Hu, in a collaboration with Taiwan University and other groups, has documented the impact of volcanic dust particles on an oligotrophic ocean gyre (Lin et al, 2011), and developed a novel remote sensing approach to estimate a large lake's bottom topography and water volume changes over time. This has led to quantification of the impact of the Three Gorges Dam on a nearby lake's water budget (Feng et al. 2011 a, b).

Boris Galperin and colleagues have discovered a new fluid flow regime they term "zonostrophic turbulence", with implications for understanding circulation and material transport in the terrestrial oceans and the atmospheres of giant planets. Data collected by the Cassini spacecraft have recently confirmed the presence of this regime on Jupiter, and experimental studies at the University of Rome have confirmed predictions of the theory for material transport.

This success of all these efforts and also of others not mentioned is a direct result of faculty and staff who aggressively pursued research opportunities and partnerships. Virtually all of these research teams include both our faculty and our students, giving students the opportunity to work on real world problems in which they can apply the approaches that they have learned in the classroom.

### **Graduate Education:**

Our enrollment remains strong and the quality of students applying for admission has been truly impressive. Currently there are 112 highly talented graduate students (64% Doctoral, 36% Master's) pursuing degrees and 11 post-doctoral fellows advancing knowledge in the areas of biological, chemical, geological, and physical oceanography and sensor development and we look forward to growing that number over time.

We are also proud of our efforts to promote training of underrepresented minorities in marine science. In 2010-2011, 19% (3 out of 16) of our graduates and 38% (3 of 8) of our PhD graduates were underrepresented minorities. Since 2007-2008, 100% of our underrepresented minority students have completed their degrees (none dropped out or transferred to another program). This is a higher successful completion rate over this period of time than our overall student population.

Our students are succeeding in multiple venues, as evidenced by a variety of awards and fellowships. A few highlights include:

- Julie Galkiewicz (PhD 2011 with Pam Hallock Muller) was selected for a 2012 Dean John A. Knauss Marine Policy Fellowship.
- Adrienne George (MS 2011 with Pam Hallock Muller) was awarded a McKnight Fellowship to pursue her PhD. She also received an NSF East Asian Pacific Summer Institute (EAPSI) 2012 fellowship.
- Dinorah Chacin (MS student with Chris Stallings) was awarded an NSF Graduate Research Fellowship.
- Erin Symonds (PhD Student with Mya Breitbart) received the EPA STAR Fellowship.
- Tasha Snow (PhD Student with Ben Flower) received the 2012-2013 Integrated Ocean Drilling Program (IODP) Schlanger Fellowship.
- Paul Suprenand was selected by NSF to participate in a UNOLS Chief Scientist Training Cruise on the R/V *Wecoma*, Fall 2011
- Ana Arellano, Claudia Barron-Aguilar, Natasha Mendez-Ferrer and Maria Vega-Rodriguez were selected for the 2011 Successful Latina Award at USF.

### **Fundraising:**

In the 2011-2012 academic year, gifts from generous donors allowed the College of Marine Science to award over \$300,000 in endowed fellowships to 26 CMS graduate students. Additionally we received \$10,000 in support of the Oceanography Camp for Girls and \$25,000 in support of IOI-Coastal Cities Summit II 2012 from Progress Energy. In September 2011, Anna C. Kuhlman joined the College of Marine Science as Director of Development.

### **Facilities:**

CMS has received quite a facelift in the last year. MSL has been painted and new bathrooms completed. KRC has gotten a new roof and the windows caulked. In 2010, Bob Jolley was successful in obtaining ~\$1.9M of ARRA funds from NSF for the renovation of the second floor laboratories in MSL. With Bob's retirement, I have assumed PI duties, but the heavy-lifting is being done by Joe Donnelly. Permitting took longer than expected, but construction is underway with an anticipated completion date of June 2012.

### **Faculty Retreat:**

I organized and led the Faculty Retreat in October 2011. At the retreat, I presented a powerpoint review on University and College metrics and budget. The bulk of the meeting centered on working group reports and recommendations. These working groups were assigned to address majors issues brought up in the External 7-year Review ([http://www.marine.usf.edu/documents/CMS\\_External\\_Review\\_2011.pdf](http://www.marine.usf.edu/documents/CMS_External_Review_2011.pdf)), which occurred in spring 2011.

### **New Partnerships:**

The youngest son of legendary ocean explorer Jacques Cousteau, Pierre-Yves Cousteau, will make St. Petersburg the U.S. headquarters for his international organization, **Cousteau Divers**. Cousteau Divers North America will have access to the leading technology being developed at the College's COT, and at SRI St. Petersburg. The College will house Cousteau Divers North America until long-term office space is established.

### **Awards and Achievements**

Faculty, staff and alumni continue to garner awards and recognition.

- Bob Byrne has been elected a Fellow of the American Geophysical Union class of 2012. We can't wait to see him in a tuxedo at the 2012 AGU Fall Meeting.

- Mya Breitbart was also elected as a member of the Executive Committee of the International Committee on the Taxonomy of Viruses in 2011.
- Pamela Hallock Muller was invited to serve a 3-year term on the International Scientific Advisory Board for the Leibniz Center for Marine Tropical Ecology, Bremen, Germany.
- Post-doctoral research associate Dr. Karyna Rosario was awarded the 2012 William M. Sackett Prize for Innovative Research.
- Dr. Teresa Greely, Education & Outreach Coordinator, was selected to fill the Education Officer position on board the Integrated Ocean Drilling Program (IODP) R/V JOIDES Resolution for Expedition 340 to the Lesser Antilles.
- David Mearns, College of Marine Science graduate (M.S., '86), was selected as co-recipient of USF's Distinguished Alumni Award.
- Flo Cole, Jim Mulhollan and Desiree Woroner received the USF Outstanding Staff Awards.

We feel proud of these achievements; they are significant in their own right but they also serve as milestones that mark College of Marine Science's growth and development. The efforts and dedication of colleagues and the support of friends make it all possible. We look forward to sharing more good news with you in the coming months.

Jacqueline Dixon  
*Dean, College of Marine Science*