Message from the Dean

When it came time to prepare this year’s annual report, the theme became abundantly clear: Degrees of Change.

Scientists are not in the business of advocacy – solid science depends on smart, objective research. At the Rosenstiel School we take great pride in our own thoughtful, objective studies. However, to think that our science doesn’t ultimately effect changes would be quite naïve. Clearly, research isn’t intended to just stay in a lab or within the paper it’s communicated on. Research clearly has its place in the midst of making changes, and I believe quite strongly that our research is increasingly doing just that.

I also believe we all want our world to be a better place. And as the world changes, it is our duty to understand this evolution and what it means for life on this planet presently and in the future. This year, the term “climate change” has been bandied about in record proportion. Maybe the documentary, *An Inconvenient Truth*, was responsible for this, or maybe – universally – people have recognized the realities of dramatically rising carbon dioxide levels, oceans that are rapidly increasing not only in temperature, but acidity, and global air circulation patterns that are shifting in new, surprising ways.

At the Rosenstiel School, a majority of researchers study climate change from an impressive number of angles. Even as I write this, we have coral reef scientists constructing a unique, new lab that will study how corals react to controlled, simultaneous changes in water temperature and acidity. We are embarking on a mammoth project with scientists not only from all around our school, but from a few others as well to put theory to the test and to work to truly restore an Antiguan ecosystem that has been stressed from overfishing and warming. We are taking genomics to Little Salt Spring to learn more about the secrets contained within this unique, anoxic climate history vault. But, I get ahead of myself. For this report is rich with science from 2006 – all of which provides varying degrees of information to understanding our planet Earth better.

In 2006, while the world seemed to wake up to the concept of climate change, our researchers were publishing research that they had spent, in some cases, a lifetime studying. This report again can only provide a snapshot of one year in science, but we hope it gives those who read it a chance to understand the complexity of climate change science, and the even greater breadth of how our research extends far beyond that.

Within these pages, you will see how our scientists scrutinized the Earth for climate change clues from the atmosphere’s higher levels to ocean depths where they discovered and explored newfound reefs in our own backyard. They swept the air and sea, too, evaluating carbon dioxide changes and other pollutants and chemical “tracers.” They looked for historic clues to climate change, especially with new high-tech tools that analyze sediment samples in hours instead of weeks. They left no cell behind, constructing a genomic map of the smallest zooplankton to learn – even there – about climate change. They reached out to business and agriculture to bridge their science to the “real world” and help them understand the impact of climate change on their bottomline. And the students who were seamlessly integrated in this work, finding research opportunities both near and far, and pursuing their own science – they also made a difference to what we do at the Rosenstiel School every day, and ultimately the degree of change we can make together.

Never doubt that a small group of thoughtful, committed people can change the world. Indeed, it is the only thing that ever has. Margaret Mead said that about her own anthropologic endeavors. As a scientist, I believe it’s hard to find more thoughtful, committed individuals than scientists, and that the best hope we have for addressing climate change and its impacts is, in fact, science. Step by step, scientists, like those here at the Rosenstiel School, will indeed provide the answers that can produce meaningful solutions.

Otis B. Brown, Jr.
Dean
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Cover photo: A research diver in the Tortugas Ecological Reserve monitors the biodiversity of the recovering marine habitat, part of Rosenstiel School’s biennial census in the Dry Tortugas. Read about the census on page 18. Photo Credit: Jiangang Luo, MBF
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Sponges, corals, and gorgonians flourish in a Western fore reef in the North Sound of Antigua. Photo Credit: Aletta Valigara, MBF
While climate change and global warming have become household terms, scientists are examining the implications of the phenomenon further by quantifying contributing factors. Rosenstiel School scientist Dr. Brian Soden actively works to quantify man-made versus naturally occurring damage to Earth’s upper atmosphere. In 2006, he and a team of scientists made headway with two new research models: one to depict ozone cooling patterns and one that calculates how global warming is altering large air circulation patterns and the resulting consequences. Soden and colleagues published their work in the journal Science on this first model that found the stratosphere is cooling because of global warming damage, which in turn has led to an increase in ozone depletion and the heightened frequency of ozone breakdown. Situated between 10km and 50km above Earth’s surface (closer at the poles), the stratosphere is the second closest layer of Earth’s atmosphere. It is internally stratified in temperature with warmer layers resting above and cooler layers below. This layering is caused as the area inside it containing relatively high concentrations of ozone (an “ozone layer”) absorbs solar ultraviolet radiation from above. Interestingly enough, the bottom of the stratosphere is often the height around which planes tend to cruise during commercial flights.

This new model of scientific research into the atmosphere has shown that the relative cooling of this layer over the past 25 years is more complex than originally thought. As was well publicized in the past few decades, ozone depletion attributed to humans comes from a wide range of sources, most notably the burning of fossil fuels and the presence of chlorofluorocarbons (CFCs) released into Earth’s stratosphere. The molecularly stable CFCs stay intact into Earth’s stratosphere. The ozone depletion attributed to the past 25 years is more complex than can be understood by just tracking man-made carbon dioxide levels.

The latter model, which Soden and colleagues wrote about in the journal Nature, suggests that an approximately 3.5 percent weakening of tropical Pacific atmospheric circulation has occurred since the mid-1800s in an air system known as the Walker circulation. They also cite evidence that it may weaken another 10 percent by 2100. This paper holds significant weight as the Walker circulation has profound effects on weather and climate patterns around the globe. Soden says we are moving toward a more El Niño-like climate. He notes this slowdown has modified the structure and circulation of the tropical Pacific Ocean, a source of nutrients to one of the most biologically productive regions of the world’s oceans, which has significant implications for ecosystem sustainability as well.

From here, Soden and his colleagues will continue to collect new information, adjusting the model to further improve what it can tell them about Earth’s future climate.

The one piece of evidence of global warming no one can dispute is that atmospheric carbon dioxide levels are higher than ever. And they only continue to increase. Likewise, oceans also face the consequences of increased carbon dioxide levels, which will have serious repercussions on marine ecosystems and our global environment.

This year, Rosenstiel School chemists finished their 2006 leg of the Climate Variability and Predictability (CLIVAR) Repeat Hydrography program, a global effort to identify where in the ocean the growing amount of man-made carbon dioxide resides, its concentrations, distributions, and changes over time — measurements that may eventually help scientists understand, model, and predict how changes in global ocean chemistry affect the ocean’s role in moderating climate change and atmospheric carbon dioxide.

Half of the anthropogenic carbon dioxide released to the atmosphere has accumulated in the ocean — mostly in the upper ocean — and is slowly mixing into deeper waters. This year, Rosenstiel School scientists took sail in the North Pacific Ocean from Tahiti to Kodiak, Alaska, stopping every 90 nautical miles to collect data. The ship spent roughly 90 days to complete its journey, collecting water samples to log water temperature, conductivity, and other chemical data.

Rosenstiel School scientists and project principal investigators Drs. Dennis Hansell, Rana Fine, and Frank Millero, are helping other scientists to create a comprehensive decadal time-scale of the ongoing ocean sampling paths. Each scientist covered a separate portion of the research. Millero’s group analyzed samples to measure changes in ocean chemistry. Fine’s group with Dr. Jim Happeg provided data about rates of mixing, transport, and other processes within the ocean, while Hansell’s group measured carbon residing in organic matter. Global ocean surveys are extremely costly and thus infrequent, but they help to understand and model climate change and carbon system dynamics. Ultimately, because of this research we can understand how human activities have forced the ocean to absorb extra carbon dioxide from Earth’s atmosphere and preview the ocean’s future.
Scientists study pollution trail

It’s easy to slip into the mindset that pollution is something you can see, smell or touch. Oftentimes, it is. But chemists will quickly clarify that pollution often leaves invisible trails that require more analysis to better understand its current impacts and future effects.

Rosenstiel School scientists have taken complementary approaches to better understand air pollution. For Drs. Elliot Atlas and Daniel Riemer, professors of marine and atmospheric chemistry, 2006 took them to some of the most polluted cities in the world and remote, downwind areas that this pollution potentially impacts.

According to Riemer, cars create the most air pollution, especially those built with low emissions standards. However, organic and inorganic trash burning comes in as a close second. In the past 15 years, developing countries have quickly become more industrialized but have also left many necessary safeguards behind. While this may seem like only a local problem, it’s not. Toxic emissions from one country travel high into the air, spreading out over miles, traveling along suspect pollution pathways consistent with prevailing wind conditions. By looking at Houston’s changing air composition, he assessed how chemicals degrade and disperse and their impact on overall global air quality. Houston has the most severe air quality issues in this country. An earlier 2002 assessment showed petrochemical plants had large air composition impacts. He is currently analyzing data to determine if the situation has worsened.

Funded by NASA, NSF, and NOAA, he examined major urban areas and background atmospheric impacts. Currently Mexico City, Houston, Lagos and Mumbai are the key study sites. Beyond urban pollution, Atlas and Riemer use additional land, ocean, and air-based studies to look at global implications. For example, both scientists study pollution composition that reaches the North Pacific tropical Atlantic, and Southern and Indian oceans. Oceans produce a lot of the naturally formed chemicals transported to the stratosphere and can contribute to ozone depletion. Atlas’ measurements extend into the stratosphere, using high altitude aircraft and large balloons to study the ultimate fate of industrial and natural chemical emissions.

Atmospheric composition data for the world’s emerging mega-cities, large, industrialized urban areas around the globe, are where pollution is worst, and that’s where Riemer, Atlas and colleagues collected approximately 1,180 samples to assess air pollution levels. By looking at Houston’s changing air composition, he assessed how chemicals degrade and disperse and their impact on overall global air quality. Houston has the most severe air quality issues in this country. An earlier 2002 assessment showed petrochemical plants had large air composition impacts. He is currently analyzing data to determine if the situation has worsened.

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Environmental impacts are occurring at rates in excess of 20mm/year, with an average sinking rate throughout the city of roughly 6mm/year.

What really happened with the levees in New Orleans? Many people think that much of the catastrophe suffered by thousands in the city’s poorest areas could have been buffered if only city officials had checked on the status of the levees. In a study titled “Subsidence and Flooding in New Orleans,” published in a May 2006 issue of the journal Nature, scientists from the Rosenstiel School have found evidence to suggest that some of the levees were indeed operating at standards below their original design model.

Most of New Orleans is sinking as the larger Mississippi Delta slowly slides into the Gulf of Mexico, and as the organic soils of former marshes corrode and compact. Dr. Tim Dixon, lead author of the research paper and a Rosenstiel School geophysics professor, has found that in some areas, subsidence is occurring at rates in excess of 20mm/year, with an average sinking rate throughout the city of roughly 6mm/year.

Rosenstiel School authors have concluded that when global sea level rise is factored into their analysis, the average rate of subsidence of the city relative to sea level is even higher – averaging about 8mm/year.

Although for most this may not seem like such a dramatic rate, Dr. Falk Amelung, one of the paper’s co-authors, also from the Rosenstiel School, thinks the impacts could be rather significant. Researchers predicting an increase in this trend over the next 20, 30, or even 100 years estimate that reconstruction plans for the city must take this subsidence into consideration. Dixon has found that some locations where levees failed were also places where subsidence was highest. These levees were built over 40 years ago and have since sunk a minimum of 3 feet lower than the original design level.

This information comes from analysis of 33 radar images taken between 2002 and 2005 from Canada’s RADARSAT satellite. The satellite exploits points on the ground that strongly reflect radar, termed “permanent scatterers,” and uses these points to plot topographic information. The study revealed that in the three years prior to the August 2005 Hurricane Katrina disaster, parts of New Orleans had already undergone rapid subsidence. The new map indicates that the levee next to the Mississippi River-Gulf Outlet (MRGO) canal that failed during peak storm surge could be explained by subsidence of three feet or more since the levee’s construction, placing the levee below the maximum water level.

Civil agencies assigned to assess the new levees’ durability will also have to take global warming into consideration. Dr. Shimon Wdowinski, another co-author from the Rosenstiel School, fears that further warming of Earth’s atmosphere due to greenhouse gas emissions may give rise to increased hurricane intensity, and hence increased opportunity for future flooding. These global warming effects will only exacerbate existing problems with New Orleans’ flood protection systems.

The Office of Naval Research, NASA, and NSF provided funding for this project.

Above, Falk Amelung checks his research data as he sits at a gas station in New Orleans where foundations are beginning to shift due to the rapid rate of soil corrosion and compaction. Photo Credit: Shimon Wdowinski, MGG.

Subsidence in New Orleans is occurring at rates in excess of 20mm/year, with an average sinking rate of roughly 6mm/year. At left, the ground around this pole has sunk substantially below its original level. Photo Credit: Roy Driska, LSU.

Studies reveal new issues in Mississippi Delta

Scientists study pollution trail

Clearing the Skies

Sinking Levees
In most instances, foresight is a good thing. When scientists are able to plug into a computer model ocean current, topography, algal blooms, wind, sea surface heating and cooling, and other variables that influence how anything in or on that ocean will move, that kind of foresight is invaluable.

At the Rosenstiel School, a team of ocean modelers has done exactly that, producing a 3-D ocean model in collaboration with scientists from the Naval Research Laboratory that can provide information in real-time. Among its many applications, this sort of model can help officials rapidly assess where oil spills or algal blooms are spreading, or aid search and rescue teams hoping to locate capsized boats faster.

**New 3-D, real-time model boosts ocean forecasting**

In 2006, the National Oceanic and Atmospheric Administration's (NOAA) National Center for Environmental Prediction adopted the Hybrid Coordinate Ocean Model (HYCOM) operationally to provide mariners with "nowcasts" and five-day forecasts for the entire North Atlantic Ocean.

The new model, which is the next-generation data assimilative system at the Naval Research Laboratory, is unique not only because it provides three-dimensional, global data that are of fine enough resolution to factor in the unique not only because it provides three-dimensional, assimilative system at the Naval Research Laboratory, is no stranger to ocean prediction; he published a book titled, *Ocean Weather Forecasting: An Integrated View of Oceanography*. He is also one of several scientists working hard to create predictive models to improve our knowledge of the marine environment and ocean climate; accurate forecasting to benefit local, commercial, and international environments; and develop a comprehensive and fully integrated method of ocean monitoring.

The HYCOM Consortium (http://www.hycom.org) is a broad partnership of institutions that focuses on producing in real-time a realistic depiction of global ocean features in hindcast, nowcast, and forecast mode. Other Rosenstiel School scientists integral to developing this HYCOM forecasting system with Chassignet include Drs. George Halliwell and Ashwanth Srinivasan.

The ability to monitor the direction and speed of currents across world oceans will aid diverse operations – from shipping to generalized ocean surveillance, especially search and rescue, or tracking hazards.

**The maps** of the not-so-distant future will be fully interactive, globally reaching, and rich in detailed air, water, and land variations. Scientists will be able to assess cloud density, real-time ocean surface and wind conditions, and even measure the bio-erosion, density, and melting rates of Arctic glaciers. Such advances in imaging technology might ultimately provide scientists with up-to-the-minute information about the Earth on a local to global scale, and for researchers at the Rosenstiel School, these developments may be just around the corner.

Through a contract created in 2006 between the University of Miami and Spot Image Corporation, such progressive imaging is quickly becoming a reality. The contract will provide the Center for Southeastern Tropical Advanced Remote Sensing (CSTARS), part of U M's Rosenstiel School of Marine and Atmospheric Science, with significantly better resolution, and satellite imagery of important environmental observations, including weather phenomena, sea-level changes, storm surge, and surface subsidence rates.

The expansion of CSTARS satellite imaging capabilities will provide insight into the assessment of natural disaster areas, weather forecasting, and other information that may help scientists and government agencies better understand the changing world around us.

Rosenstiel School's Drs. Tim Dixon and Hans Graber, co-directors of CSTARS, hope that this upgrade to SPOT 5 satellite imagery will provide spatial resolution that enhances what they already understand about satellite imaging. The potential implications are vast: improving shipping routes, national security measures, quicker disaster response, study of shoreline changes, and environmental monitoring.

**Satellite upgrades aid facility**

This agreement to receive much higher resolution satellite imagery from the SPOT 5 satellite, represents an important increase in the type and amount of imagery CSTARS will be able to provide. As one of the world's premier remote sensing facilities, CSTARS was the first to provide critical satellite imagery to government agencies during the hurricane response activity in 2005.

Below, satellite imagery captured this photo of the debris trail (dark line) left by the tornado that cut through central Florida in 2006. The higher resolution image, at left, shows the heavy damage sustained by homes in one area, including some homes completely destroyed. Many vehicles can be seen in the area, as well as several homes with tape on their roof. Photo Credits: SPOT IMAGE CORPORATION, acquired and processed by the Center for Southeastern Tropical Advanced Remote Sensing. University of Miami.
According to a new study, on the tiniest, free-living eukaryotic organisms, big things truly do come in small packages.

Genomic analysis of Ostreococcus tauri, a marine phytoplankton species, offers insight into its evolutionary biology and ability to thrive in the world’s oceans. Thought to be nearly 1,500 million years old, O. tauri is the smallest eukaryote (complex-celled organism) known to survive as a free-living, self-replicating cell. But O. tauri isn’t just interesting because of its small size; it is found in many marine systems and performs photosynthesis, impacting the global carbon cycle that is integrally linked to climate change.

**Taking a microscope to climate change**

This year, the Proceedings of the National Academy of Science carried a scientific paper with genomic evidence that despite this organism’s compact makeup, its genome is structurally complex, while in other aspects it is quite streamlined. The research not only made the cover of PNAS but was also highlighted in Science and other prestigious journals.

Dr. Alexandra Worden, one of the paper’s authors, is an assistant professor at the Rosenstiel School. Worden joined the faculty at the Rosenstiel School in 2004 just as she was selected as a Gordon and Betty Moore Foundation Young Investigator in Marine Microbiology, which carries an $875,000 unfettered research prize.

Worden understands that the dynamics of such organisms are critical to the current function of the global carbon cycle. They are “the plants” of the ocean, so the amount of carbon dioxide they consume via photosynthesis, and where it goes, are crucial questions to understanding how they affect ocean processes. One of the prevailing indicators of climate change and global warming has been increased atmospheric carbon dioxide. Scientists agree that the ocean plays a key role in removing excess carbon dioxide from the atmosphere in a process known as carbon fixation, a part of the carbon cycle. Photosynthetic organisms such as O. tauri consume carbon dioxide by “fixing” it (into plant material) and simultaneously releasing oxygen. This process is notably linked to prehistoric changes in Earth’s oxygen abundance. Consequently, Worden’s research focuses on the physiological controls of O. tauri growth and ultimately its role in the carbon cycle – via hints from its genome sequence. The research will lend more predictive power to issues such as the population changes likely to occur and, in turn, the oceans’ ability to deal with climate change.

An important expansion of this work is currently going on in Worden’s lab at the Rosenstiel School. Worden is the principal investigator on a genome sequencing project collaboration with the U.S. Department of Energy; again focusing on the carbon cycle. The target organisms, two strains of *Micromonas pusilla*, are closely related to O. tauri, however they have a much broader environmental distribution, thriving from polar to equatorial waters. Because of its broad thermal range, *Micromonas* may have better response capabilities for adjusting to the thermal fluctuations expected with climate change. Originally thought to be a single species, the genome sequences indicate otherwise – they cannot even be compared at the DNA level.

Worden’s team is composed of participants from around the world – but University of Miami undergraduate and graduate students are also in the mix. As part of Worden’s course “Marine Microbial Ecology: Genomic Approaches,” students have received a first shot at the unpublished genome sequences and are learning the ins and outs of integrating genomic data with the environmental challenges that confront the broader community. As Worden’s work with colleagues continues, population changes in these minute organisms may ultimately serve as indicators of shifts in the Earth’s climate. More importantly, information on how these organisms will respond to climate shifts will provide insights into future consequences for global climate conditions.

**Over a decade ago**, scientists postulated that the collapse of the Classic Maya civilization in the lowlands of the Yucatan Peninsula was linked chronologically to an extended regional drought thought to have lasted close to a century. In 2003, sediment core samples from the bottom of the oxygen-free Cariaco Basin off northern Venezuela yielded evidence that the extended drought was actually a series of shorter droughts, each lasting for a decade or less. This refinement in interpretation, which more closely matches the archaeological record, was achieved by applying novel new X-ray technology to the sediments.

This year, the Rosenstiel School received and installed a version of the instrument that made the more detailed Maya study possible. The new XRF (X-ray Fluorescence) Core Scanner is only the third to make its way to the United States, and the first of the latest model made by Avaatech, a company based in the Netherlands that originated the technology. Dr. Larry C. Peterson, associate dean of graduate studies and the marine geology professor who took part in the Maya study, hosts this new scanner in his lab. The state-of-the-art XRF Core Scanner makes possible the rapid chemical analysis of sediment and rock cores using completely non-invasive methods. It can accurately measure the abundances of elements ranging in mass from calcium to uranium and do so continuously at a sample spacing of 500 microns, all in a few hours. The scanning XRF technique is rapidly revolutionizing studies of Earth history because of the ability to generate data at a speed and resolution that only a few years ago would have been thought impossible.

A vast amount of information about past climates is preserved in the chemical composition of sediments deposited on the ocean floor, in lakes, and on land. The skeletal remains of tiny plankton that settle and accumulate on the sea floor, the weathering products of rocks on land that enter the ocean by rivers, and even airborne dust that falls into the open ocean – each have distinctive chemical signatures that can be traced and interpreted with the XRF Core Scanner. Past geological events such as tsunamis, earthquakes, droughts, and rapid climate changes all leave lasting impressions in the sediment record. Peterson and other Miami scientists are engaged in a wide suite of research projects – many focused on climate change – for which this new instrument is proving invaluable. The Rosenstiel School houses a collection of several thousand sediment cores from all the world’s oceans, so there is no lack of mud to analyze.

The new XRF technology has been hailed as the most efficient way to get fast, detailed insights into the chemical composition of sediments, simultaneously revealing Earth’s oldest stories of climate change and helping Rosenstiel School scientists better anticipate future changes.

**New tool aids paleoclimate research**

At left, scientists aboard the Scripps RV Melville get ready to deploy a 75m piston-core in the gulf of Papua New Guinea. Photo Credit: Carlos Alvarez Zarikian, MGG. Below, Larry Peterson explains the workings of his new Avaatech XRF – Core Scanner. The scanner, which allows hi-speed non-destructive chemical analysis of core samples, analyses Rosenstiel School’s extensive library of marine sediment core samples. Photo Credit: Ivy F. Kupcu
Imagine trying to map not just the biological diversity and complete topography of the Grand Canyon, top to bottom, in pitch-blackness with only a standard flashlight. Compare that with completing the entire task under a few miles of water, and it all might seem too daunting to attempt. But for some marine scientists, this example isn't that far from reality.

For marine geologists and oceanographers at the Rosenstiel School using advanced sonar techniques, exploration into the Straits of Florida between Miami and Bimini turned up extraordinary deepwater reef sites previously undiscovered.

With anywhere from 90 to 95 percent of the world's oceans still unexplored, the potential for finding new materials to develop medications looks promising. That's why Drs. Mark Grassmuck and Gregor Eberli from the Rosenstiel School have been working alongside researchers from Harbor Branch Oceanographic Institution on expeditions to explore these deepwater environments. For example, Harbor Branch has spent years researching and synthesizing chemicals with pharmaceutical properties from marine organisms to help treat diseases such as cancer, HIV, and Alzheimer's. Harbor Branch has collected tens of thousands of marine organisms sampled, many of which are now in various stages of development and government testing. For them, the deep ocean provides an undisputed source for new biological research material.

Rosenstiel School's 2006 AUV work has provided maps of five promising seafloor areas, all of which are likely to harbor a vast number of organisms. As more data are collected, scientists will be able to better predict correlations between depth and relative species diversity – a link that just may lead to groundbreaking medical discoveries.

For the deepwater ecosystem itself, the integration of bathymetric, oceanographic, geologic, and biologic properties and processes is a first step to delineate, understand, and adequately protect these diverse deepwater habitats.

As the sun rises on a new day in a Honduran banana plantation, broad green leaves yield to warm breezes that wind through the verdant landscape. It is a peaceful, bucolic setting that contradicts the scientists' work nearby, assessing a watershed laden with pollutants and other runoff.

The Mesoamerican Barrier Reef (MBR), second largest in the world, is particularly exposed to sediment, nutrient, and toxic runoff. The scientists used NASA satellite imagery to monitor nutrients – where and how quickly they disseminate – thus helping to develop an effective, integrated model that shows connectivity between land use, rivers, and reefs.

Scientists analyze land use to improve watershed

Scientists analyze land use to improve watershed planting.
The United States is now the third largest seafood consumer in the world, importing more than 70 percent of it. But, nearly half of the seafood sold for human consumption is produced through aquaculture, not caught in the wild, and that number grows steadily each year. Rosenstiel School scientists were at the forefront of aquaculture research in 2006, working to create a truly sustainable industry.

Many cultures’ sole source of protein and economic stability relies on the fishing industry, so the push has always been there to develop a healthy, sustainable way to grow fish to feed such populations and be commercially viable. In 2006, Rosenstiel School scientists were recognized for their long-term dedication and innovation in developing ecologically sustainable aquaculture.

Dr. Daniel Benetti, director of the Rosenstiel School Aquaculture Program and chairman of Marine Affairs and Policy, along with Dr. Larry Brand, a professor in marine biology and fisheries, are the principal investigators of the offshore aquaculture program that was recognized with two grants from NOAA’s National Marine Aquaculture Initiative 2006 totaling $1 million over two years. The grants support the Rosenstiel School aquaculture research agenda is driven by the needs and concerns of the industry, government agencies, NGOs and the public at large. These concerns include sustainability of natural marine habitats, reliance on fishmeal from capture fisheries, and pollution and disease issues.

The Rosenstiel School aquaculture program joins academia, private enterprise, and government, including, NOAA Fisheries Service, Snapperfarm Inc., AquaSense LLC, Great Bay Aquaculture LLC, and Ecomicrobials LLC.

Researchers recognized for offshore program

From the citrus groves in South Florida to the sugar cane fields of Brazil, farmers face increasing challenges in keeping their livelihood economically viable in the face of highly variable growing conditions. In 2006, while farmers were thankful for a mild hurricane season brought by El Niño, they faced challenges during much of the southeast’s winter growing season. The Rosenstiel School plays a key role among a unique group of climate scientists, economists, and hydrologists who work across state lines to provide guidance to the agricultural industry and others who can benefit from their research.

Known as the Southeast Climate Consortium, the scientists come from six universities: the University of Miami Rosenstiel School, Florida State University, the University of Florida, the University of Georgia, Auburn University, and the University of Alabama-Huntsville. The United States Department of Agriculture and NOAA’s Climate Programs Office provide funding.

The consortium uses nested, coupled, regional climate models to explore how best to employ a climate forecasting system to provide tailored predictive information for the agriculture industry, primarily in the Southeast United States.

Practically speaking, the group is able to aid farmers with information about climate phenomena. Last year, SECC participated in a program to increase weather awareness among potato growers in Miami-Dade county, providing foresight about the increased winter precipitation in El Niño years. With this advanced warning, growers could take precautions such as mounding their fields and clearing drainage ditches.

The SECC does not offer severe or rapid approach weather alerts, instead offering farmers the knowledge that the Earth’s current ENSO phase—El Niño, La Niña, or a neutral phase—may cause specific problems that would endanger certain types of crops, livestock, or produce. So, for example, SECC might issue warnings about the additional risk of freezes during winters not influenced by either El Niño or La Niña, even though they do not forecast individual freeze events themselves.

Climate group bridges science and farmers

Farmers and agricultural agencies in the southeastern United States, whose crops rely on moderate to warm temperatures for most of the year, have been hit hard economically. SECC is researching methods to develop and issue climate information products based on the use of seasonal climate forecasts, historical climate data, and other climate analyses to help decision-makers identify management options to reduce risk and increase profits while sustaining the ecosystems of the Southeast United States.

The SECC unites researchers from several universities in the Southeast, including the University of Georgia, Drs. Carla Roncoli and Todd Crane, who work as SECC assessment researchers with Rosenstiel School’s Dr. Kenny Brand, interact with extension agents like this one to the coastal plains of Georgia to explore decision-making processes and try to understand where long-term climate forecast information might help them adapt by adjusting management practices. Photo credit: Joel Paz, University of Georgia
Protected reserves and "no-take" areas are often controversial marine management decisions. However, when diligent monitoring can back up that policy decision with science to show whether the reserve is doing what was intended – helping to rebuild a suffering ecosystem – then everyone wins.

That was exactly the case in 2006 as Rosenstiel School’s Dr. Jerry Ault set out with about 45 other marine biologists, including students to conduct his biennial census of the Tortugas Ecological Reserve in the Keys to monitor ongoing population changes and observe the effects of hurricanes on the coral reef habitat in the Reserve. And the conclusion was that since the federal government set it aside as a no-take zone in July 2001, this area now has more fish and bigger fish – inside the reserve, but also beyond. Every other year, Ault returns to the Tortugas with his team to count fish, lobster, and corals.

The Dry Tortugas, a remote area about 70 miles west of Key West, is known for its extensive coral reefs, fish, sharks, lobsters, and other marine life. In 2001, the Florida Keys National Marine Sanctuary was allowed to set aside no-take areas, forming the Tortugas Ecological Reserve (TER), to help address the critical state of overfishing in the region.

In November 2006, the Florida governor and cabinet approved implementation of a management plan for an additional Research Natural Area or no-take marine reserve in the Dry Tortugas National Park to complement the existing TER. The Florida Fish and Wildlife Conservation Commission also concurred with the proposed National Park Service regulations related to marine fishing in the park that became effective in January 2007, and Ault’s data played prominently in the decision-making process. The Dry Tortugas corals offer a unique display of colors. The biennial census helps to monitor the improving status of marine life inside the reserve and in the surrounding marine areas. Below, this unique, striped Highhat has a safe haven in this protected area. Photo Credits: Jiangang Luo and Jerry Ault, MBF

Opposite, the Dry Tortugas corals offer a unique display of colors. The biennial census helps to monitor the improving status of marine life inside the reserve and in the surrounding marine areas. Below, this unique, striped Highhat has a safe haven in this protected area. This year, a first-ever sighting came in the form of a Marble Grouper (below). Photo Credits: Jiangang Luo and Jerry Ault, MBF

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Ault, along with Dr. Steven Smith (also from the Rosenstiel School) and Dr. James Bohnsack of the NOAA Fisheries Service, published a research paper in the *Bulletin of Marine Science* this year, citing the increase in number and size of black groupers and other snappers in the Dry Tortugas. They have been conducting research there since 1999. Domain-wide abundances of several exploited and non-exploited species have increased, while no declines were detected. Between 2000 and 2004, for example, Ault has seen the occurrence of black grouper jump from 19 to 29 percent at the sites that he routinely visits during this census, and regional stock abundance of black grouper has increased by 124 percent. This year, one of the more notable events, too, was Ault’s own sighting of a marbled grouper – very rare in the Keys – and further indication that the ecosystem is truly rebounding. Ault and his team conduct biennial fish abundance surveys on the more than 260 species that comprise the Tortugas’ reef fish community in the Florida Keys. This year, his team was also documenting changes in fish abundance and habitat quality after six major hurricanes since the last survey in June 2004. Collecting scientific data on a regular basis is imperative to understand the dynamics of the ecosystem and to provide sustainable fishery management recommendations. The Dry Tortugas region plays a critical role in the health of the overall Florida Keys coral reef ecosystem, thus making this study important to understanding the overall functioning of tropical marine habitats.

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It sounds like such a simple idea.

Take side-by-side pictures and stitch them together to get a big picture perspective of coral reefs. But this low-tech concept is quite complicated. Boosted by the latest technology of remotely operated vehicles that can traverse the sea floor in systematic fashion producing high-resolution pictures, images are fed into a computer program that can build a bigger picture autonomously, the result: an impressive single mosaic image that allows scientists to observe coral reefs intensively and extensively.

Over the past four years, graduate students working with Dr. Pamela Reid, Rosenstiel School associate professor of marine geology and geophysics, have done exactly that. Inspired by photographer Jim Helhemen’s 7x20 meter coral mosaic of Bloody Bay Wall, a world-famous dive site off the coast of Little Cayman Island, graduate student Art Gleason conceived the idea to create coral mosaics that could be used by scientists and government organizations for routine monitoring of marine sites. Though the inspiration came from beautifully crafted “fine art” pieces, Gleason, Graduate Assistant Brooke Gintert, and Research Assistant Professor Diego Litman wanted something more, trading fine art quality for ease of scientific use. The aesthetic quality of the mosaics became less important than getting the measurements quickly and efficiently.

To achieve the goal of routinely producing underwater video mosaics, Rosenstiel School scientists partnered with Dr. Shahriar Negahdaripour and post-doctoral researcher Dr. Nuno Gracias from the University of Miami’s College of Marine, Stars, and Planetaria, Dr. John Gifford, the principal investigator and underwater archaeologist at the University of Miami Little Salt Spring project, uncovered many artifacts during his annual two-week field class with graduate students — this time another rare greenstone pendant, estimated at 6,000-7,000 years old. This became the third known example in Florida of an Archaic pendant made from an exotic rock type. The discovery is just one of several that Rosenstiel School researchers have indirectly dated in Florida’s prehistory known as the middle Archaic Period. Buried when the water level of the spring was several meters lower, the artifacts have recently been excavated by scientists exploring the site. Gifford believes that the two pendants recovered from Little Salt Spring may have their origins somewhere in the southern Appalachians, leading him to propose some form of long distance trade (700 to 800 miles) between central Florida and the Southern Appalachians. Gifford and others are now utilizing a form of non-destructive analysis to characterize the elemental and mineral composition of the artifacts so that they may be matched to a more specific geographical source.

In addition to excavating more of Florida’s very ancient past, Gifford obtained education and outreach funding to share the collection of artifacts in special exhibits, including a multimedia presentation, around Florida and host a special day of tours and workshops at the spring itself. The events aimed to raise public awareness of Little Salt Spring’s contribution in furthering scientific research and to give local residents further insight into their deep past. Since the spring was gifted to the university 24 years ago, the Little Salt Spring Archaeological and Ecological Preserve has demonstrated great potential for elucidating the prehistory and paleoenvironmental evolution of Florida. The site, a 240-foot deep, hourglass-shaped spring is fed from underground water sources completely lacking in dissolved oxygen. Under such conditions, bacteria cannot grow and decompose organic material such as bone and wood, leaving many unique relics preserved for thousands of years.

Located in North Port, Fla., about 10 miles from the Gulf of Mexico, Little Salt Spring was first explored in the late 1950s. Archæological excavations in the 1970s led to the discovery of artifacts dating as far back as 12,000 years ago. The spring was donated to the University of Miami in 1982 and has been listed on the National Register of Historic Places since 1979. Surrounded by an undisturbed native hardwood hammock that contains several rare and endangered plant and animal species, Little Salt Spring has become the site of an interdisciplinary field school for undergraduate and graduate students. With roughly 95 percent of the spring unexplored, many believe what remains inside will offer important evidence of early human activity, climate variations, and changes in the plant and animal makeup southwest Florida.

At left, John Gifford speaks to a crowd at the Little Salt Spring Open House. The greenstone pendant shown above was exhibited in 2006. Photo Credit: Steve Koski.
The assumption that scientific advances will necessarily benefit large groups of people, particularly in less industrialized countries, is often false. That is the driving force behind the research of Dr. Kenny Broad, assistant professor of marine affairs and policy at the Rosenstiel School of Marine and Atmospheric Science and UMI's Abess Center for Ecosystem Science and Policy and also a 2006 National Geographic Emerging Explorer. An environmental anthropologist, Broad has dedicated himself to studying nature-culture interactions, by analyzing the uses and misuses of scientific information in different parts of the globe. In particular, he studies how forecasts of future conditions – including hurricanes, El Niño events, climate change, and ecosystem patterns – are manipulated as they enter the political arena, the private sector, and individual households.

Traveling to remote locations along with colleagues from the physical and cognitive sciences, and working closely with local groups and national policy makers, Broad tries to direct the strengths of different disciplines toward solving pressing problems related to natural resource management. It was Broad's efforts to inspire change that earned him the title of Florida Outstanding Woman in Public Health for 2006. Fleming is the only board-certified occupational and environmental medicine physician and epidemiologist in South Florida. Additionally, she is acting director of the Florida Cancer Data System, Florida's incident cancer registry, and co-director of the National Science Foundation-National Institute of Environmental Health Sciences University of Miami Oceans and Human Health Center – one of only four such centers in the United States.

Environmental anthropologist named National Geographic Emerging Explorer

National Geographic's choice was also largely based on Broad's exploration of some of the most remote, dangerous areas of the world. Among other things, he is an experienced underwater cave diver, having led and participated in several scientific and documentary film expeditions, including the exploration of one of the world's deepest caves in the Huastla Plataux in Mexico. Underwater caves serve as a reservoir of unique ecological biodiversity and cultural artifacts, as well as to supply local people with their primary water source. Unfortunately, many of those caves are now in danger due to pollution and rising sea level associated with climate change. Broad talks of caves as one of the last places on earth where humans must physically go to explore. He is currently planning to lead a large scale, multidisciplinary expedition to explore and conduct research on the cultural and biological significance of underwater caves in the Bahamian archipelago.

It's through this extreme science, and merging insights from the natural and social science disciplines, that Broad finds ways to make science and exploration meaningful to society.

Dr. Karen Broad, after a dive in the Hart Spring System, one of the largest spring-fed diving areas in the state of Florida. Photo Credit: Amy Clemens, MPO

The Rosenstiel School faculty constantly make their mark. This annual report highlights only a fraction of the research done in 2006. Additionally many faculty passed milestones or received personal honors. Here are just a few from this year:

Clues G.H. Roth retires

Distinguished Professor of Meteorology and Physical Oceanography and Assistant Director of the Cooperative Institute for Marine and Atmospheric Studies, Dr. Clues G.H. Roth, retired this year after more than 30 years at the Rosenstiel School. Roth's career was spent studying both the ocean and atmosphere, and the interactions between them that are pivotal to understanding weather and climate.

Roth's scientific contributions have helped formulate ideas for representation of deep circulation processes and their causes in global numerical models. His personal example and work have sparked the interest and research of a great number of other successful scientists in his field. Roth has always been a researcher who thinks in broad, creative ways. His ideas have consistently inspired colleagues to question and rethink traditionally held views and produce pioneering science throughout the world.

Florida recognizes Lora E. Fleming

Dr. Lora E. Fleming, faculty at both the Rosenstiel School and the Miller School of Medicine, has dedicated some of her current research to studying the human health effects of aerosolized red tide toxins and the possible human health effects of microbial pollution in recreational beach waters.

As a result of Fleming's leadership and dedication to this research, the University of South Florida College of Public Health awarded her the title of Florida Outstanding Woman in Public Health for 2006. Fleming is the only

Gregor Eberli, Peter Swart become AAAS fellows

Nominated by a select panel of respected scientists, two Rosenstiel School faculty were chosen as 2007 American Association for the Advancement of Science (AAAS) Fellows for their global scientific and technological contributions. Drs. Gregor Eberli and Peter Swart, former and current chairs of the Division of Marine Geology and Geophysics, were elected as AAAS Fellows in the organization's geology and geography category, joining the ranks of seven other past fellows from the Rosenstiel School, and yielding a total of 19 AAAS fellows university-wide since the organization began electing them.

Sharon L. Smith travels to Oman as Fulbright Scholar

After spending years researching climate change, zooplankton, and impacts on food webs in the Arctic, Dr. Sharon Smith from the Division of Marine Biology and Fisheries was awarded a Fulbright Scholar Award. Starting in Fall of 2006, she began a research project in Muscat, Oman, where she is spending nine months teaching and studying zooplankton changes during the monsoon season, specifically as they relate to global warming models that forecast important changes to the marine food web there. Working from the Department of Marine Science and Fisheries at Sultan Qaboos University in Muscat, Smith will teach undergraduates and mentor graduate students in their plankton research, even training a plankton technician in the Ministry of Agriculture and Fisheries.

Faculty Spotlight

Chairman of the Biology Department at the Rosenstiel School of Marine and Atmospheric Science, Dr. Kenny Broad, has been named National Geographic Emerging Explorer. Broad writes about his research approach:

"I think about the human condition all the time. I'm interested in how we respond to change. It's through this extreme science, and merging insights from the natural and social science disciplines, that Broad finds ways to make science and exploration meaningful to society."
Rosenstiel School of Marine and Atmospheric Science

Most people recycle in some way or another. We save pennies in old coffee cans, use glass jars to store nails in our garage, and each week we separate our trash into glass, plastic, and paper, making sure we do our part to recycle, reduce, and reuse whatever we throw out. We usually draw the line when it comes to bodily waste, but for the toadfish, using its bodily waste wisely is essential to its survival.

Urea is a biological waste product most often associated with land mammals due to the high amount of energy needed to produce it. But unlike most fish, which excrete waste by releasing ammonia into the ocean, toadfish secrete a carefully balanced mixture of ammonia and urea. Scientists are interested in the shelter when they released a mixture of artificial toadfish-shelter, while the snapper were much less interested in the shelter when they released a mixture of ammonia and urea into the water. The scientists also tested the effects of a mixture of urea and an amino acid and found the ammonia positively attracted fish to attack an artificial toadfish-shelter, while the snapper were much less interested in the shelter when they released a mixture of ammonia and urea into the water. The scientists also tested the effects of a mixture of urea and an amino acid and found no evidence of this cloaking mechanism. Urea alone does not act as an arbitrary chemical in the defense mechanisms of bony fish. This study represents the first case of a “waste” chemical excreted solely to distort an organism’s own chemical signals.

Ammonia is highly attractive to toadfish’s most lethal predator, grey snapper, so over time the toadfish have evolved a system of producing waste that will not draw attention to its presence. Ammonia in the ocean, toadfish secrete a carefully balanced mixture of ammonia and urea. Scientists and Rosenstiel School alums Drs. Patrick Walsh (B.S. ’75) and John Barimo (Ph.D. ’95) studied the toadfish’s motives in producing urea and came to the conclusion that the toadfish has evolved a system of producing waste that will not draw attention to its presence.

In the end, it’s a risky trade-off between expending more energy to create different waste molecules and becoming a tasty meal. But by most standards, the sacrifice isn’t that hard to justify. Related studies are showing that increased nitrogen concentrations in coastal waters, a factor affecting ammonia, has become a global environmental problem and this could affect how predatory fish find their food.

Walsh is currently a professor of biology at the University of Ottawa and holds a Canada Research Chair in Environmental Health and Genomics. His recent studies focus on the impact of natural stressors on the molecular physiology of fish. Barimo is a postdoctoral fellow at Portland State University.

Rosenstiel School alums are known for making a difference – making varying degrees of change in the work they ultimately do. Michelle Mainelle, MS ‘00 (MPO), became the first female hurricane specialist at the National Hurricane Center in 2006. John Reynolds, MS ’77, PhD ’80 (MBF), was the 2006 Alumni Lecturer because of his role as chairman of the Marine Mammal Commission. Those are just a few highlights. If you know of Rosenstiel School alums who have been recognized for the good works they do, let the school know.

Contact the Communications staff at 305/421-4704.

The Golf Classic

Ask golf pros and they’ll tell you that golf ostensibly is a complicated science – the physics behind the perfect swing, the parabolic flight of the ball, adjustments made to compensate for wind resistance. And while chemistry might not seem to be a factor, it was a mostly chemist team that found the winning formula and who took the top prize in Rosenstiel School’s fourth annual Alumni Golf Classic. The 2006 tournament raised nearly $12,000 to benefit the alumni fellowship, which funds new graduate students.

Top place honors went to the Marine Physical Chemistry Group (which also included a marine biologist), composed of Drs. Frank Millero, Jerry Ault, David Kadko, and student Adam Radich. For the second year in a row, they also took the Rosenstiel School Insider’s Cup.

Team Eden Roc placed second and included Claus Mouller, Mark Burcher, Ryan Hoeper, and Shaggy Hemhauser. The South Florida Water Management District Team, composed of Humberto Alonso, Michael Palmero, Alberto Sosa, and Scott Thorp, placed third. In last place was the Rosenstiel School Werth Team, made up of students: Deanna Donohoue, Leo Llinas, Lyza Johnston, and Ian Zink.

Alumni fundraising aims to support the Rosenstiel School Alumni Fellowship, awarded annually to an incoming graduate student. The 2006 recipient was Jennifer Grimm from the Division of Marine Affairs and Policy.

Alumni Board

The board each year looks for ways to support the school’s students and involve increasing numbers of alumni. This year’s board consisted of the following:

Jennifer Schull Johnson, president
Erica Rule, vice president
Stacy Reeder, secretary
Matthew Davis, past president

If you are an alum, and you want to get in on other fun get-togethers and help support the Rosenstiel School, contact alumni@rsmas.miami.edu.

Alumni Spotlight

Shown below, Drs. Pat Walsh (left) and John Barimo (right) worked together on their toadfish research at the Rosenstiel School prior to Barimo’s graduation. At right, “Big Bubba” is the largest gulf toadfish the two ever found. Photo Credit: John Barimo, MBF

Alumni News

Emerging from the laboratory of Dr. Frank Millero at the Rosenstiel School is a new technology developed at the University of Ottawa that can measure the amount of ammonia in seawater with an accuracy and speed that has left many scientists breathless.

“This device is exciting,” said Millero, who is also a Rosenstiel School alumnus, the third of four. “It’s the first time we’ve been able to get such accurate readings in real time.”

Millero and his team were able to develop the technology in just a few years, thanks to a small grant from the Natural Sciences and Engineering Research Council of Canada. The device, called a “wet cell,” is designed to be used in concert with another device that measures the amount of urea in seawater.

Millero said the technology is so accurate that it could be used to monitor the environment for the presence of ammonia, which is a key component of global warming. The device can also be used to monitor the amount of urea in seawater, which is a key component of the ocean’s acidity.

The technology is being used in a number of different fields, including agriculture, where it can be used to monitor the amount of ammonia in the soil. It can also be used in the food industry to monitor the amount of ammonia in the air, and in the beer industry to monitor the amount of urea in the beer.

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Most students only dream about skipping their regular science classes for a trip on the open ocean to study sharks. In 2006, a group of high school and undergraduate students got to live out that scenario by helping scientists and graduate students at the Rosenstiel School with ongoing local shark research and conservation efforts. Collecting and analyzing shark data, students helped monitor South Florida’s marine ecosystem while dispelling public misconceptions about sharks.

The South Florida Student Shark Program (SFSSP) is a multidisciplinary research and education program in which Rosenstiel School professors and graduate students expose high school students and undergraduates to marine science field work. Students from South Broward High School, the MAST Academy, and the University of Miami worked cooperatively to understand South Florida’s coastal sharks and associated mangrove communities, which Rosenstiel School professors and graduate students monitor South Florida students and undergraduates to marine science field work. Students from South Broward High School

Students partake in local research, conservation

School, the MAST Academy, and the University of Miami worked cooperatively to understand South Florida’s coastal sharks and associated mangrove communities in and around Biscayne and Florida Bay. Public presentations and data collected from the program were disseminated to the scientific community and the general public through journals, scientific reports and conferences, school presentations, civic organizations, the media, and student run websites.

Principal investigators from Rosenstiel School’s Division of Marine Biology and Fisheries, Neil Hammerschlag, a graduate student and assistant, and Dr. David J. Die, a research associate professor, set up the program to provide students with hands-on education and self-initiated research, both in the lab and field. Supervised by world-class experts in six major subject areas: biology, genetics, chemistry, navigation, engineering and IT, students are trained in many disciplines to encourage young scientists to pursue further education in natural sciences.

For undergraduate and graduate students, the program has multiple benefits; furthering their continued science education, while empowering them to play a more active role in the scientific preparation of younger students. 150 students traveled to key sites where they sampled sharks and fishes as well as built and controlled their own Remotely Operated Vehicles (ROV) fitted with cameras to film wild sharks in their habitats. Students also helped examine the presence and concentration of mercury in coastal sharks, characterize the genetic structure of Florida shark species, the extent of gene flow among sampling sites, determine the diet of coastal sharks, and identify their important feeding sites.

After only its first year, a time for staff and administrators to learn what works and what doesn’t for the program, Rosenstiel scientists are optimistic for the future of the SFSSP. The program has now teamed with local NGOs, the Herbert W. Hoover Foundation and the Southern Florida Chapter of the Explorers Club, as well as collaborating with Biscayne National Park to generate information important for managing and conserving the park’s natural resources.

Rosenstiel School is proud of all its student award winners. This annual report includes short research profiles on three of the top student awards: Melicie Desflots Fritz Koczy Fellowship Current research: Desflots’ dissertation focuses on the physical processes involved in hurricane intensity changes. Much progress has been made in hurricane track forecasting, however forecasting storm intensity is still challenging because scientists are missing some important pieces in the puzzle to understand exactly how environmental factors and hurricane internal dynamics affect intensity. With the help of a high-resolution, state-of-the-art numerical model developed at the Rosenstiel School, she is trying to understand how different environmental factors, especially vertical wind shear and surface heat fluxes, affect hurricane intensity. Desflots and other scientists believe that if they can understand how these factors impact hurricanes, they can also improve numerical models for intensity forecasting.

Peter LaFemina F.G. Walton Smith Prize Current research: LaFemina studies plate boundary zones and integrating geologic and geophysical data to solve geodynamic problems. Specifically, he uses GPS to observe changes in Earth’s surface across active faults, fault systems, and on active volcanoes. These data and geologic and geophysical observations build models to better understand the processes behind lithospheric deformation. He currently is doing research in Iceland, Central America, the western United States, and Ecuador.

Noel Gourmelen Frank J. Millero Prize Current research: Plate tectonics currently shapes the western United States, causing earthquakes, volcanic eruptions, and slow, continuous motions, impossible to observe with the naked eye. Precise radar techniques can measure ground motion that moves at literally only a few millimeters per year in the large geographic area known as the western Basin and Range. With knowledge of the deformation, Gourmelen and other geologists pinpoint where seismic and volcanic activity occurs using modeling. Also, the observation of those phenomena – earthquakes, volcanic activity, slow deformation – is often the only way to assess the nature of the plate that forms the western United States and that “rocks” that lie several tens of kilometers below the surface.
Climate change is an unavoidable fact of life— but our ability to anticipate and cope with change has not been predetermined...

—Tuandi Agardy, “Impacts of Climate Change on Northeast Waters: Long Island Sound through the Gulf of Maine,” presented March 8, 2005 at the CT Science Center Collaborative

From being lost at sea in Guinea Bissau in a leaking dugout on her way to a remote, sacred turtle-nesting island, to founding Sound Seas, a Maryland-based nonprofit organization that promotes effective marine conservation through science and sociology, Dr. Tuandi Agardy has traveled around the globe to educate herself and others about environmental issues where people can effect meaningful change.

While Agardy has many accolades to her name, one she can now add to her list is the 2006 Rosenstiel Award for Outstanding Achievement and Distinction in Oceanographic Science. The Rosenstiel School recognized Agardy’s work this year in marine conservation and coastal management and her role as an interface between public policy and community-based conservation efforts.

Agardy’s research has spanned the globe, allowing her to conduct field and policy work in Algeria, the Black Sea region, Canada, Cape Verde, throughout the Caribbean, Guinea-Bissau, Indonesia, Italy, Mexico, Papua New Guinea, Tanzania, and Zanzibar. International and regional authorities have sought her input in coastal resource management, marine protected area planning, fishery and other resource management, and capacity building.

In 2005, she was the coordinating lead author for the seminal report, the Millennium Assessment, synthesizing all marine findings of this comprehensive report for the United Nations Environment Programme to create a useful document for agencies and nongovernmental organizations involved in marine conservation. A prominent expert on marine protected areas, Agardy authored a comprehensive treatise on the subject and created an ecosystem services “toolkit” for the Ecological Society of America to help scientists communicate outside their own community about jeopardized marine ecosystems.

The Rosenstiel Award is designed to honor scientists who, in the past decade, have made significant and growing impacts in their field. It’s an award targeted for researchers who, in their early to mid-career stages, are already making outstanding scientific contributions.

Through an endowment from the Rosenstiel Foundation recognizing outstanding marine scientists, Agardy was chosen under the award’s rotation to the Marine Affairs and Policy division, the Rosenstiel School’s social science unit offering links between natural resource economics, political ecology and marine anthropology, with those of ocean and coastal law policy. ▲

From a work trip in the Galápagos, below, to underwater field work, above, conducting a feasibility study for establishing a research station (now in place) in the Palmyra Atoll, Tuandi Agardy’s conservation work has taken her around the globe. Photo Credits: Maria Agardy (below) and Chuck Birkeland (above).
If it weren't for the satellites, silently orbiting earth, sending continuous readings about the status of Earth's climate, oceans, and atmosphere, much of modern marine science would be nearly impossible. Scientists have found that satellites are wonderful tools for measuring Earth systems, even things that can't normally be "seen," like sea-surface temperatures. Sea-surface temperatures have become an important part of monitoring climate changes, so not surprisingly, these measurements demand accuracy.

On Royal Caribbean International's Explorer of the Seas, Dr. Peter Minnett has found a way to validate satellite data using the ship's unique, very efficient labs. An assortment of researchers have worked aboard Explorer of the Seas, which is outfitted with state-of-the-art labs that also include research equipment to explore and assess the accuracy of satellite measurements and lead to improvements in how space-borne data can be utilized.

Minnett's primary research focus has been on satellite-based sensing of the ocean. To ensure his satellite data are correct, he validates them with other data sources, and Explorer of the Seas has extraordinarily good equipment for his work. Because the ship sails over essentially the same track on its voyages, he is also able to take advantage of an immense repetitive data source as well. As a collaborative effort between the Rosenstiel School and Royal Caribbean International – with funding from NOAA and the Office of Naval Research – Explorer offers scientists, research staff, and students unparalleled access to labs that are out on the ocean 365 days a year. He then compared Explorer's lab measurements to those from instruments on the NASA satellite Aqua when the satellite overflew the ship. The second study was similar to the first but focused on the thin sea-surface "skin" temperatures measured from the MODerate-resolution Imaging Spectroradiometers (MODIS) on two NASA satellites, Aqua and Terra. Minnett's project demonstrated the deployment of autonomous skin sea surface temperature radiometers for use on voluntary observing fleet ships.

It's the combination of instruments that provides very accurate skin sea-surface temperatures, radiosondes that measure atmospheric temperature and humidity, and a microwave radiometer that allow Minnett to do his research so successfully in this creative, unique lab setting. NASA and the National Oceanographic Partnership Program (NOPP) have funded these research projects.

New equipment speeds up larval billfish research

Billfish, which encompass sailfish and blue and white marlin, have diminished greatly, despite "no-take" laws along the U.S. eastern seaboard. Recent research suggests a 90 percent loss in the ocean's top predatory fish. With billfish, the problem of conservation is exacerbated because they tend to be very mobile, thus they need protection all over the Atlantic, not just U.S. shores. Additionally, scientists and anglers actually know very little about their spawning, growth, and behavior.

The Walton Smith's netting capabilities provide convenient and first-rate collection of delicate larval specimens. As researchers learn more about billfish growth, development, and reproduction, they can determine what might help fish stocks to replenish — the ultimate research goal.

Cowen's recent research focuses on the role of juvenile billfish in the recruitment of fish, population connectivity in marine fish, and the early life history dynamics of billfish. His research has been conducted on both reef-related and pelagic species throughout the Caribbean, along the East Coast of the United States, California, and Mexico.

The Walton Smith is a state-of-the-art research catamaran designed and built to meet the needs of Rosenstiel School scientists and researchers. Since its creation, the Walton Smith has served other academic institutions, private research organizations, and governmental agencies such as the U.S. Navy for their own research expeditions.

Funding for Cowen's instrument testing comes from several sources, including the National Science Foundation (NSF), and the University of New Hampshire through a grant from NOAA.

F. G. Walton Smith Scientists

There's no place like your home ship. Perhaps that should be the mantra of Dr. Robert Cowen, who has done a wide array of larval billfish field studies, thanks to the Rosenstiel School's home research vessel, the R/V F. G. Walton Smith.

While Cowen, professor and chair of the Division of Marine Biology and Fisheries, has spent many a cruise in past years collecting larval billfish, in 2006 he started to take his research up another notch, testing new hi-speed imaging equipment that will be used in future research voyages that will allow new analyses right at sea. Cowen and his team created the equipment themselves and will use it in 2007 for further research.

Cowen's previous research aboard the Walton Smith took place over three years as he studied the larval dispersion of billfish in the upper layers of the ocean as indicators of reproductive activity. Billfish, as one of the most popular sportfish around, play heavily in the Florida economy, so they have economic importance on top of just being a good indicator species to Florida's marine ecosystem. Billfish are as well-known for their giant size and terrific fighting abilities when hooked as they are for being among the top predators in the oceanic food chain. Unfortunately, habitat in the recruitment of fish, population connectivity in marine fish, and the early life history dynamics of billfish...
Throughout the year, Rosenstiel School faculty, students, and staff have opportunities to share what they know with the local community. During the summer, teacher and at-risk student programs help generate enthusiasm for science in the Dade county public schools. The school is involved in the ocean science Manatee Bowl each year, hosting it every other year. And, there are countless opportunities that bring children and adults onto the campus, interacting with scientists and learning more about the planet they live on.

Annual Underwater Photography Contest
The Rosenstiel School has made a name for itself as an institution that values new ways to see the world around it. In its second annual underwater photography contest, the school saw a remarkable explosion of international interest. Photographers from around the world submitted more than 375 images to the competition to be judged in one of three categories: “wide angle,” “macro,” and “fish or marine animal portrait.”

Nearly all the finalists in this year’s selection hailed from outside South Florida. With a team of professional photographers and marine scientists as judges, the contest’s top prize was awarded to David Kearnes of Kailua Kona, Hawaii, a wildlife photographer and co-founder of the Kona Underwater Photographic Society. Evan D’Alessandro, a marine biology and fisheries graduate student, won the student category for the second year in a row, but another student, Neil Hammerschlag also won the “wide angle” category. Other category winners were Patrick Weir (“macro”) and Andre Seale, B.S. ’97, UM (“portrait”).

Sea Secrets
The Rosenstiel School and the Ocean Research and Education Foundation expanded the highly acclaimed and very popular (standing-room only!) lecture series, Sea Secrets in 2006, taking it on the road. For the first time, residents in Naples, Fla., were treated to three Sea Secrets lectures there, thanks to a new relationship with the NCH Healthcare System, the Curtis & Edith Munson Foundation, and Private Bank of Bank of America, which sponsored the lecture expansion. The Rosenstiel School designed this series of evening programs specifically for the non-scientific community to learn more about our blue planet and to meet distinguished scientists and explorers from around the world.

The Rosenstiel School is one of the nation’s top oceanographic research and education institutions. A leader in developing innovative partnerships with government, industry, and foundations, the school has had impressive success in receiving funding for its proposals. Approximately one out of every two proposals submitted is awarded the requested funding.

The Rosenstiel School ended 2006 with total research support at $54 million. Its external funding totaled $46.2 million, with federal grants coming predominantly from the National Science Foundation, NOAA, Department of Defense, NASA, and the National Institutes of Health.
The following lists the names of organizations and individuals who donated $100 or more to the Rosenstiel School of Marine and Atmospheric Science from June 1, 2005 to May 31, 2006. We are deeply grateful for their partnership.

$250,000 - $499,999
Collins F. Fain and Richard D. Fain

$100,000 - $249,999
Allison Farrel Virginia P. Storer, BBA '51, and Peter Storer, BBA '62

$50,000 - $99,999
Anita B. Chase, AB '76, JD '74

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Joan Summerville, Nancy R. Wong, and Myron Wang

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Judith L. George and Philip T. George, AB '51, and Peter N. Storer, AB '76, and Elaine I. Chan, MS '79, and Walter M. Hester, JD '69

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Reneen Brewer and Harold Brewer, Martha H. Harrison and Christopher G. Harrison, Ph.D. Stephanis J. MacMahan, AB '86, and Thomas F. MacMahan, MD '82

$1,000 - $1,999
Jonathan D. Blegen, AB '98, and Jon R. Buck, MS '70

The 2006 Donor Honor Roll

The Rosentreter School of Marine and Atmospheric Science also extends its sincere appreciation to all those volunteers who have contributed so much of their time and effort to the school and those organizations who also provided matching gifts.

Honor roll information has been carefully reviewed; to the school and those organizations who also provided matching gift organization.
On July 26, 2006, the Rosenstiel School lost one of its brightest members. Tony’s sudden passing, so early in his life, was a tragedy to all of us at the Rosenstiel School and the science community, at large.

Tony was born in Lebanon, where he received the Baccalauréat-C degree in physics and general sciences from Sacré-Coeur school. Following his doctoral studies, Tony carried out a postdoc at NASA Goddard and the Applied Physics Laboratory (APL) of Johns Hopkins University. This was followed by two years as an assistant senior staff physicist at APL. During his years at APL, Tony worked on a variety of problems related to electromagnetic scattering and nonlinear wave theory. Tony then returned to France as a researcher at the Centre National de la Recherche Scientifique (CNRS) in the field of remote-sensing turbulence in fluid mechanics of nonlinear media. In 2004, he joined the Rosenstiel School as associate professor of applied marine physics.