

Fieldwork

## USGS Scientists Gather Images and Information About Recent Hurricanes

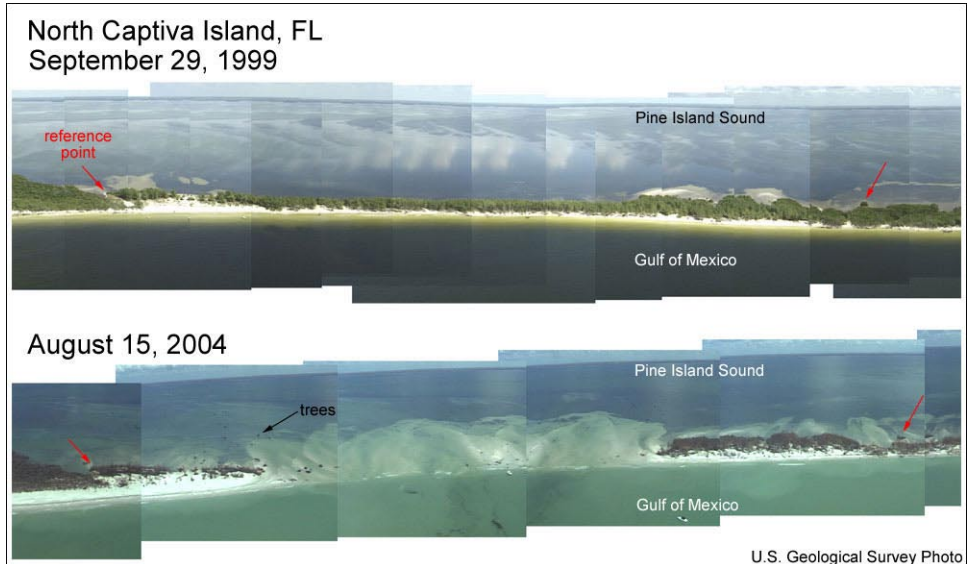
By Abby Sallenger

Hurricane season has kept scientists at the U.S. Geological Survey (USGS) Center for Coastal and Watershed Studies in St. Petersburg, FL, busy both personally and professionally, as they divide their time between preparing homes for the next storm and working to document the most recent damage.

The striking results of their efforts—conducted in partnership with the National Aeronautics and Space Administration (NASA) and the U.S. Army Corps of Engineers (USACE)—can be viewed on the USGS Hurricanes and Extreme Storm Impact Studies Web site at URL <http://coastal.er.usgs.gov/hurricanes/>.

An early set of photographs posted on the site records a new breach through North Captiva Island, a barrier island off the southwest coast of Florida where Hurricane Charley's eye wall came ashore on August 13, 2004. USGS scientists **Dennis Krohn, Karen Morgan, and Russ Peterson** flew over the coast two days later to photograph the impacts of the category 4 hurricane. On August 16, USGS personnel quickly put together "before" (September 29, 1999) and "after" (August 15, 2004) mosaics of the breach that were published on August 17 in the *New York Times*. The photos can be viewed on the USGS Hurricane Charley Web site at URL <http://coastal.er.usgs.gov/hurricanes/charley/>.

Also on the Web site, posted just days after Hurricane Charley, is a vertical color-infrared (IR) photograph, acquired by the NASA Experimental Airborne Advanced Research Lidar (EAARL) system, that shows destruction of trees on North



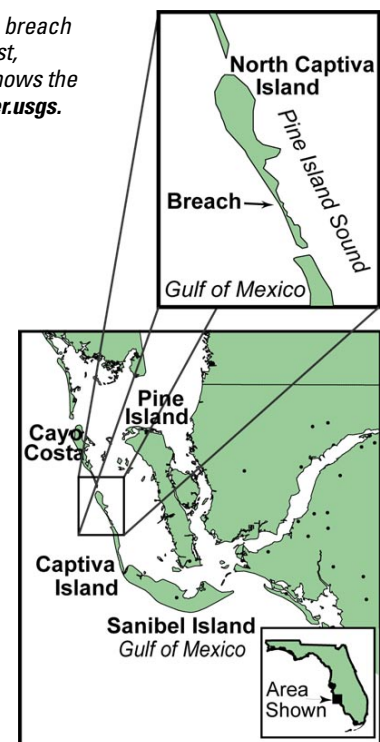
U.S. Geological Survey Photo

*Before-and-after photographic mosaics of a 450-m-wide breach through North Captiva Island on Florida's southwest coast, caused by Hurricane Charley on August 13, 2004. Map shows the island's location. (Viewable online at URL <http://coastal.er.usgs.gov/hurricanes/charley/>.)*

Captiva Island. Each of the felled trees is aligned with the dominant wind direction. The site also has images of trees completely stripped of leaves, reminiscent of what happened when Hurricane Andrew hit south Florida in 1992. Three-dimensional topographic and bathymetric images produced from lidar (light detection and ranging) data collected in September 1998, May 2004, and August 2004 show how the breached area of North Captiva Island has changed over time.

Category 2 Hurricane Frances came ashore on the central Atlantic coast of Florida on September 5, 2004. On September 8, USGS scientists began acquiring

*(Hurricanes continued on page 2)*



## Sound Waves

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## Submission Guidelines

**Deadline:** The deadline for news items and publication lists for the December 2004/January 2005 issue of *Sound Waves* is Wednesday, December 8.

**Publications:** When new publications or products are released, please notify the editor with a full reference and a bulleted summary or description.

**Images:** Please submit all images at publication size (column, 2-column, or page width). Resolution of 200 to 300 dpi (dots per inch) is best. Adobe Illustrator© files or EPS files work well with vector files (such as graphs or diagrams). TIFF and JPEG files work well with raster files (photographs or rasterized vector files).

Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

## U.S. Geological Survey Earth Science Information Sources:

Need to find natural-science data or information? Visit the USGS Frequently Asked Questions (FAQ's) at URL <http://ask.usgs.gov/faqs.html>

Can't find the answer to your question on the Web? Call **1-888-ASK-USGS**

Want to e-mail your question to the USGS? Send it to this address: [ask@usgs.gov](mailto:ask@usgs.gov)

## Fieldwork, continued

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ing data, and their preliminary assessment of the coastal change caused by the hurricane is available on the Hurricane Frances Web site at URL <http://coastal.er.usgs.gov/hurricanes/frances/>. Included on this site are before-and-after photographs of coastal erosion and overwash deposits carried landward by waves and storm surge.

Category 3 Hurricane Ivan came ashore near Gulf Shores, AL, on September 16, 2004, causing heavy damage along the coast. The next day, USGS scientists conducted an aerial-photographic survey of the barrier islands in Alabama and Florida that were affected by the hurricane. Some of the resulting photographs have been posted on the USGS Hurricane Ivan Web site, at URL <http://coastal.er.usgs.gov/hurricanes/ivan/>, paired with prestorm photographs, taken in July 2001, to illustrate the extreme coastal change produced by Hurricane Ivan.

*(Hurricanes continued on page 3)*



▲ Before-and-after photographs of destroyed houses in the barrier-island community of Orange Beach, AL. The houses were built on top of a dune that was severely eroded during Hurricane Ivan. Note the walkways in the prestorm photograph that once served as pathways down to the beach. (Viewable online at URL <http://coastal.er.usgs.gov/hurricanes/ivan/photos/index.html>.)

◀ Before-and-after photographs of an overwash deposit (to right of middle oceanfront house) at Floralton Beach on Florida's central Atlantic coast, caused by Hurricane Frances on September 5. Waves and storm surge overtopped the crest of the beach and drove sand landward, covering vegetation and part of the road. Similar overwash deposits were formed sporadically along the coast. (Viewable online at URL <http://coastal.er.usgs.gov/hurricanes/frances/>.)

## Fieldwork, continued

(Hurricanes continued from page 2)

Category 3 Hurricane Jeanne came ashore on the central Atlantic coast of Florida on September 25, 2004. USGS scientists took photographs of the damage on September 29 and have posted before-and-after pairs on the USGS Hurricane Jeanne Web site at URL <http://coastal.er.usgs.gov/hurricanes/jeanne/>. Some of the photographs document damage by erosion of sand dunes and undermining of structures, and others document damage by deposition of sand in overwash deposits. Photographs grouped in threes—a shot of a coastal area in 1997, a shot of the same area after Hurricane Frances, and a shot of the area after Hurricane Jeanne—show progressive erosion by the two hurricanes, which hit Florida's central east coast just three weeks apart.

Please continue to visit the Hurricanes and Extreme Storm Impact Studies group of Web sites, where new information and images will be posted as they become available. ❁



*Dune erosion by successive hurricanes undermined houses in Vero Beach, FL (upper photograph: 8/12/97; middle: after Hurricane Frances, 9/8/04; bottom: after Hurricane Jeanne, 9/29/04). At the time of the first photograph, the seaward face of the dune was vegetated. After Hurricane Frances, the dune had retreated to the edge of the house. During Hurricane Jeanne, the dune eroded farther and undermined the house. (Viewable online at <http://coastal.er.usgs.gov/hurricanes/jeanne/photos/index.html>.)*

## Drilling Monitoring Wells in Dry Tortugas National Park—Fahrenheit 100, Blue Sky, Blue Water, Crumbling Bricks, and Here Comes Hurricane Charley

By Gene Shinn

On August 3, the U.S. Geological Survey (USGS) Florida Integrated Science Centers (FISC) drill team, consisting of geologists **Don Hickey** and **Gene Shinn**, microbiologist **Dale Griffin**, and hydrologist **Ann Tihansky**, cranked up their hydraulic drill in the moat of a Civil War-era fort. They were drilling in the water-filled moat surrounding historic Fort Jefferson at Dry Tortugas National Park, some 65 miles west of Key West, FL. The heavy equipment had been transported from Key West to the remote park on the National Park Service's supply boat, the motor vessel *Fort Jefferson*. The team lived for a week aboard the research vessel *Papa-San* anchored in the harbor.

The project, funded by the USGS Biological Support in National Parks program, is designed to (1) monitor fecal pollutants and nutrients in the carbonate-island water lens underlying historic Fort Jefferson, (2) determine the island's geologic framework,

and (3) determine annual fluctuations in the ephemeral freshwater lens. Pollutants in the ground and surface water are suspected to be influencing surrounding coral reefs.

The first and most grueling step of the 2-year project was the installation of 10 monitoring wells in midsummer heat. Eight wells were core drilled to 18-ft depth and screened. Core drilling allows core samples to be recovered from the hole for later analysis. Screening entails putting a piece of polyvinyl chloride (PVC) pipe down the hole, with a cap at the bottom and fine slits cut through the lower section of the pipe, so that water but not sand can enter the pipe for sampling. A ninth well was cored to 46-ft depth and screened, and the tenth was cored to a depth of 62 ft below sea level. The last well penetrated pre-Holocene coral at 55-ft depth.

As the last well was being drilled, tension was building—Hurricane Charley

(*Tortugas continued on page 4*)



*The Tortugas drill team (left to right): Gene Shinn, Don Hickey, Ann Tihansky, and Dale Griffin onboard the research vessel Papa-San.*

## Fieldwork, continued

(Tortugas continued from page 3)

was on the way. The group headed for Key West to avoid the storm's projected path. Sure enough, the eye of Hurricane Charley passed directly over Fort Jefferson on August 12, causing considerable damage and forcing the park to close. The wells are reported to be undamaged. During the next 2 years, the wells and surface waters in the surrounding anchorage and camping area will be monitored every 3 months for fecal coliforms, nutrients, and salinity. Tough duty, but someone has to do it.

For those who have never heard of Dry Tortugas, it is the site of the largest Civil

War-era red-brick fort. The fort was never completed. Rifled cannon made such forts obsolete, and construction was halted. Fort Jefferson has had many functions. It served as a jail. Its most famous prisoner was **Dr. Mudd**, the doctor who set the leg of **John Wilkes Booth** after he shot **Abraham Lincoln**. The fort also served as a coaling station for ships before the turn of the century and was the last stop for the U.S. battleship *Maine* before it blew up in Havana Harbor.

Today the fort is visited daily by two fast catamarans that each disgorge about 100 tourists. A constant stream of pontoon seaplanes arrives from Key West every hour or two. Visitors also arrive by private boat, and campers occupy the small camping area and swimming beach outside the fort. The adjacent island is famous for its sooty terns that land and breed on the island after returning from their annual migration to Africa. In recent months, there has been a new form of landing—about



Installation of another well in the transect.

65 Cuban refugees recently arrived in the middle of the night. It is a place with a rich historical past and an interesting future. An \$8-million reconstruction project to replace bricks has just begun. The National Park Service is looking for volunteer bricklayers. Any takers?\*



Drilling a well at Fort Jefferson. **Gene** (right) operates the drill. **Don** is on the winch.



Carrying core inside a core barrel to the moat wall.

## Persistence of Coral Reefs Under Extreme Environmental Stress in American Samoa

by Greg Piniak, Charles Birkeland, and Ginger Garrison

About 30 percent of the world's coral reefs are severely damaged, and as much as 60 percent may be lost by 2030, according to the report "Status of Coral Reefs of the World: 2002" (see URL <http://www.gcrmn.org/>). Recent articles in the journal *Science* suggest that the trajectories of decline are similar worldwide, although the damage is most severe in the western Atlantic—where coral cover has declined by 80 percent over the past 30 years. These documented coral declines,

in combination with predicted global climate change, make it imperative that management of coral-reef systems take into account the processes that control their resilience.

Resilience is a key trait of reef corals in the National Park of American Samoa on Ofu Island in the South Pacific, where the corals undergo extreme environmental stress: temperatures in some pools reach 35.5°C and can fluctuate daily by more than 6°C, dissolved oxygen ranges from

23- to 212-percent saturation, and pH varies as well. Such conditions might cause excessive mortality on other reefs, owing to thermal bleaching, yet a diverse assemblage of more than 100 coral species persists on Ofu.

In August 2004, we began fieldwork for a 3-year project to examine the intrinsic and extrinsic factors that make Ofu corals so resilient. Intrinsic factors include acclimatization (changes in the corals' bio-

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## Fieldwork, continued

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chemical properties, the type of symbiotic zooxanthellae, or the composition of the microbial community), adaptation (differential survival of larvae or recently metamorphosed spat with different genetic traits, differential recruiting of larvae with different susceptibilities, local recruitment from adapted populations), and (or) susceptibility to disease. Extrinsic factors, such as water motion, dissolved-oxygen levels, sunlight intensity, or sediment abrasion, could also affect the resilience of corals under thermal stress.

Project leader **Charles Birkeland** (USGS Hawaii Cooperative Fishery Research Unit, University of Hawai'i, Honolulu) and his graduate students **Lance Smith** and **Dan Barshis** are spearheading transplant studies to test the response of corals to different microhabitats. Corals were transplanted between the forereef and the reef moat, or between different pools in the reef moat. One set of experiments uses staining with alizarin (a red dye with an affinity for calcium) to measure coral growth under different conditions. A second series of experiments will monitor the biochemical characteristics of the corals, including the production of heat-shock proteins and mycosporine-like amino acids (MAAs), which control temperature- and light-induced bleaching by protecting corals from thermal stress and ultraviolet-light (UV) exposure. In addition, polymorphic nuclear markers will



Aerial view of the reef moat and pools on the south shore of Ofu Island in the National Park of American Samoa. Photograph by **Greg Piniak**.

be developed to investigate the fine-scale genetic structure of the coral colonies, in order to determine whether some corals are more genetically suited for thermal tolerance than others.

**Ginger Garrison** and **Christina Kellogg**, of the U.S. Geological Survey (USGS) Center for Coastal and Watershed Studies in St. Petersburg, FL, are characterizing the microbial communities associated with three coral genera (*Pocillopora*, *Porites*, *Acropora*) in two environmental regimes over a 15-month period. They will use both mucus (surface community) and

tissue samples to investigate changes in microbial communities in response to temperature and, possibly, bleaching. The intent is to determine whether non-destructive sampling (of mucus) can be used to predict changes in the microbial communities and survival of coral colonies. The data on the microorganism-community changes will be integrated with other data collected from the coral colonies: genetics, molecular

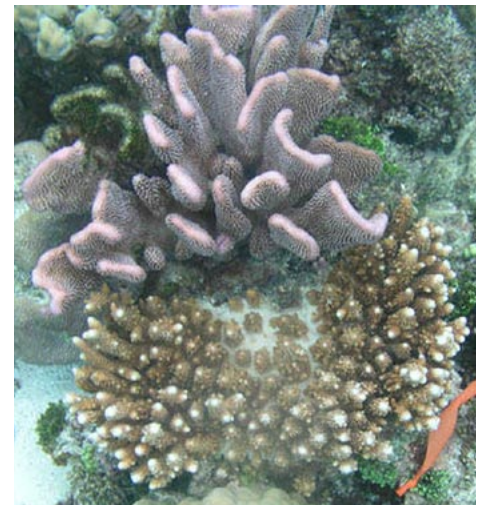
markers, colony survival, and environmental variables.

**Greg Piniak** (USGS Pacific Science Center, Santa Cruz, CA) and **Eric Brown** (University of Hawai'i) are using a diving pulse-amplitude-modulated (PAM) fluorometer to study the fluorescence yield of the corals' symbiotic zooxanthellae. This study seeks to determine species-specific bleaching vulnerability by comparing seasonal changes in the daytime and nighttime fluorescence of 10 common

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University of Hawai'i graduate student **Lance Smith** transplants coral fragments. Photograph by **Eric Brown**.



Transplant donor colony of *Pocillopora eydouxi* (top) and a neighboring colony of *Acropora gemmifera* (bottom). Photograph by **Ginger Garrison**.

## Fieldwork, continued

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coral species in different reef-moat microhabitats. A related study will examine the relation between photosynthetic electron-transfer rate and ambient light conditions, and whether seasonal temperature regimes



Massive *Porites microatoll* in the Ofu reef moat. Photograph by **Ginger Garrison**.

affect that relation.

This multidisciplinary project is funded by the USGS Biological Resources Discipline. Other research collaborators outside the USGS include **Peter Craig** (National Park of American Samoa); **Ruth Gates, Michael Rappé, and Rob Toonen** (Hawai‘i Institute of Marine Biology); **Dan Barshis, Lance Smith, and Jonathan Stillman** (University of Hawai‘i); **Andrew Baker** (Wildlife Conservation Society); and **Rob van Woesik** (Florida Institute of Technology).✿

**Greg Piniak** uses a pulse-amplitude-modulated (PAM) fluorometer to gather data from corals in the Ofu reef moat. Photograph by **Peter Craig**.



## USGS Dive Team Completes Installation and Recovery of Samplers in Ashumet Pond, Falmouth, MA

By **Rick Rendigs**

U.S. Geological Survey (USGS) Woods Hole Science Center dive-team personnel **Mike Casso, Dann Blackwood, and Rick Rendigs** and Field Dive Officer **Charles Worley** successfully completed the final phase of the installation and recovery of seepage samplers from sediment in Ashumet Pond, Falmouth, MA. The work was undertaken during August 3-6, 2004, in collaboration with **Denis Leblanc** and **Tim McCobb** of the USGS Water Resources Discipline.

This effort complemented an earlier USGS dive-team reconnaissance study conducted in June 2004 to characterize the occurrence and offshore extent of phosphorus-rich ground water flowing into the pond (see article in *Sound Waves*, July 2004).

The source of the phosphorus is a former sewage-treatment plant located on the Massachusetts Military Reservation. The plant, which operated from 1936 to 1995, released treated effluent into infiltration lagoons upgradient from Ashumet Pond. Scientists have long known that phosphorus was leaking into the pond, but the site of its entry—in ground water discharging into the pond along the northwest shoreline—has only recently been mapped. The initial detection of elevated concentrations of phosphorus flowing into the pond came from a cofunded research effort between the U.S. Air Force and the USGS Toxic Substances Hydrology Program.

Data provided by USGS scientists from these studies has assisted with planning

the location and offshore extent of remediation efforts that have recently begun in Ashumet Pond, where an “iron barrier” is being installed along the pond’s northwest shoreline. An area approximately 300 ft long, 40 ft wide, and 3 ft deep will be excavated in the pond bottom. This area will then be covered with a mixture of excavated pond sediment and iron flakes. The phosphorus in ground water flowing through this iron-rich sediment will stick or “sorb” onto the iron mixture, thus reducing the amount of phosphorus that enters the pond. This methodology is expected to trap the phosphorus for many decades. Further monitoring of the pond by USGS scientists will continue after installation of the iron barrier.✿

## Research

### Florida’s Geology Makes Wastewater Disposal a Potential Threat to Ecosystem Health in the Florida Keys

By **Dale W. Griffin**

The Florida peninsula sits atop a limestone platform thousands of meters in depth. Most of the platform is overlain by a veneer of silicate sand, but in many

coastal environments this cover is absent. Given the porous nature of limestone, it is in these coastal environments that the disposal of wastewater, or the use of such

wastewater-disposal systems as septic tanks and shallow injection wells, presents unique problems relative to human and

(*Wastewater Disposal* continued on page 7)

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ecosystem health. Waste-disposal practices are of particular concern in the Florida Keys, one of the State's tourist meccas, where more than 36,000 septic systems, an estimated 5,000 to 10,000 cesspits (covered limestone holes that serve as septic tanks), and more than 600 shallow class IV injection wells (approx 30 m deep) are the dominant systems of wastewater disposal.

The central problem with these systems is that wastewater is deposited directly into limestone environments, which are in close association with surface waters and the potable waters of the Biscayne aquifer. Pollutants and pathogenic microorganisms are rapidly transported to canal, nearshore, and offshore environments by the influence of tidal pumping. Several studies in the Florida Keys that used bacteriophage as tracers by flushing them down various toilets demonstrated that these microorganisms could be detected in canal surface waters in as little as 3 hours. A study that

screened 19 different sites covering the full length of the Florida Keys demonstrated that specific human pathogenic viruses (Polio and Coxsackie viruses, Hepatitis A virus, Norwalk viruses, and others) were present at all but one site. This study specifically demonstrated the prevalence of human fecal-oral pathogens in canal and nearshore waters, but other constituents such as detergents, various cleaners, and whatever else might be disposed of in household sinks may pose significant threats to ecosystem health.

Although many of the problems associated with these types of wastewater-disposal systems exist in Florida's coastal communities, it is the coral reefs of the keys and the susceptibility of corals to pollutants and nutrients (natural and anthropogenic) that have resulted in numerous scientific endeavors to understand the physical, chemical, and biological sources of stress to this valued ecosystem. Researchers have recently used coral mucus

to demonstrate the presence of specific human viruses in nearshore reef environments in the keys. Coral mucus, which is a highly charged nutrient-rich coral biofilm, is an ideal natural "flypaper" that can trap passing viruses from the overlying water column. In a paper published in the journal *EcoHealth* (v. 1, p. 317-323, "Analysis of Coral Mucus as an Improved Medium for Detection of Enteric Microbes and Determining Patterns of Sewage Contamination in Reef Environments"), **Erin Lipp** (University of South Florida) and **Dale Griffin** (U.S. Geological Survey) demonstrate for the first time that human-specific wastewater-associated viruses are detectable at an outer-reef site (Alligator Reef, off Marathon) in a nearshore-to-offshore-transect water-quality study. This study and others like it will aid regional ecosystem and public-health officials in addressing management issues. (Information about the journal *EcoHealth* can be viewed at URL <http://www.ecohealth.net/>.)

## USGS Maps and Data Show Why the Gulf of Mexico's Eroding Shoreline is Vulnerable to Hurricanes

By Abby Sallenger and Robert Morton

U.S. Geological Survey (USGS) scientists focused their attention on the Gulf of Mexico coast from Louisiana to the Florida panhandle as Hurricane Ivan approached in September. The U.S. Gulf Coast shoreline is particularly vulnerable to storm surge and coastal change during hurricanes because of low elevation, shoreline retreat, and subsidence in the Mississippi Delta area.

In June, the USGS released a new assessment of shoreline change on the Gulf Coast showing that 61 percent of the shoreline is eroding. Some areas are losing sand more rapidly than others, and some areas are actually gaining sand. The assessment—a 44-page full-color report available at URL <http://pubs.usgs.gov/of/2004/1043/>—was designed to help coastal managers at all levels of government make more-informed decisions.

"At the beginning of hurricane season, coastal residents recognize how important

their beaches are, not just for enjoyment but also for protection from mighty coastal storms," said **Robert Morton**, a USGS coastal geologist and the assessment's lead author. "Beach erosion is a chronic problem along most open-ocean shores of the United States. As coastal populations grow and community infrastructures are threatened by erosion, there is increased demand for accurate information regarding past and present trends and rates of shoreline movement."

In a cooperative research program, the USGS and the National Aeronautics and Space Administration (NASA) recently surveyed the shoreline by using airborne laser mapping, providing for the first time detailed elevation maps of the "first line of defense" at the shoreline. An example of the "first line of defense" is a sand dune protecting an ocean-front cottage or road. The average Florida west coast "first line of defense" elevation is about 6 ft—less

than half the 13-ft average of the Florida east coast where Hurricane Frances made landfall on September 5.

USGS scientists have prepared maps showing where the "first line of defense" would be inundated by worst-case-scenario storm surges associated with categories 1 through 5 hurricanes; the maps can be viewed at URL <http://coastal.er.usgs.gov/hurricanes/ivan/discussion.html>.

Storm-surge elevations, simulated by the National Oceanic and Atmospheric Administration (NOAA), represent the maximum surge that results along the open coast from hurricanes of a given category, approaching from different directions and at different speeds. On Florida's west-coast barrier islands, the maximum surge typically occurs to the south of landfall under the eye wall and decreases in elevation with distance away from the eye wall.

"Where the storm surge exceeds the

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elevation of the dunes, currents will flow across the barrier islands, potentially driving massive amounts of sand landward,” says **Abby Sallenger**, USGS oceanographer. “In some places where barrier islands are low and narrow, the currents will carve new inlets, like what happened in 2003 on the Outer Banks of North Carolina during Hurricane Isabel and this year on North Captiva Island, Florida, during Hurricane Charley” (see related *Sound Waves* article, this issue).

Data generated by the USGS National Assessment of Shoreline Change Project, including vector shorelines and transects, associated short- and long-term rates of change, statistical uncertainties, and areas of beach nourishment, have been compiled on the USGS Coastal and Marine Geology Program Internet Map Server (IMS). The IMS brings the usefulness of geographic information systems (GIS) to a Web browser, allowing the user to view and manipulate data layers interactively.

The USGS U.S. Gulf of Mexico Shoreline Change IMS can be found at URL [http://coastalmap.marine.usgs.gov/ArcIMS/Website/usa/GoMex/shoreline\\_change/viewer.htm](http://coastalmap.marine.usgs.gov/ArcIMS/Website/usa/GoMex/shoreline_change/viewer.htm).

A data catalog complements the IMS and the assessment report mentioned earlier by offering downloadable data layers complete with Federal Geographic Data Committee-compliant metadata. These data can be found at URL <http://pubs.usgs.gov/of/2004/1089/>. ❄

## Outreach

### Festive Open House at the USGS Pacific Science Center

By Helen Gibbons

The new U.S. Geological Survey (USGS) Pacific Science Center in Santa Cruz, CA, received a warm welcome from the community when it held an open house on September 18 in celebration of the USGS’s 125th anniversary. A steady stream of visitors, estimated to number about 400, enjoyed viewing posters, engaging in hands-on activities, and talking to USGS scientists about their work.

A highlight of the day was actor **Earll Kingston’s** performance of a one-act play about the exploration of the Grand Canyon by **John Wesley Powell**, the USGS’s second director. Preceding the play were opening remarks by **Sam Johnson**, director of the Pacific Science Center and chief of the Western Coastal and Marine Geology Team, which hosted the event; **Gary Griggs**, director of the Institute of Marine Sciences at the neighboring University of California, Santa Cruz; and **Wes Ward**, USGS Western Regional Geologist.

Display topics ranged from faulting and seawater intrusion in the Monterey Bay area, through California sea-otter studies, to research on coral reefs in Hawaii and new observations of submarine hydrothermal systems in the West Pacific. Colleagues from the National Oceanic and Atmospheric Administration (NOAA) Southwest Fisheries Science Center’s Santa Cruz Laboratory hosted a popular exhibit at which they challenged visitors

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**Sam Johnson** welcomes visitors to the Pacific Science Center. Photograph by **Francis Parchaso**.



Volunteer **Parker Allwardt** holds a plastic tray steady as a visitor traces a contour line to make a three-dimensional model of Monterey Canyon. Photograph by **Francis Parchaso**.



**Curt Storlazzi** explains to visitors how floating “drifters” were used to track the movement of newly spawned coral larvae in an effort to understand variations in the health of Hawaiian coral reefs (see related article in *Sound Waves*, August 2003). Photograph by **Francis Parchaso**.



## Outreach, continued

(Pacific Science Center continued from page 8)

to “Name the Rockfish.” Stations spread throughout the center enabled visitors to take virtual flights over tsunamis and sea-floor bathymetry, create their own three-dimensional models of Angel Island and Monterey Canyon, smell oil samples from around California, view the formation and destruction of sand ripples in a see-through flume, and much more.

The Pacific Science Center opened at its present location in December 2003, and planning for the open house and 125th-anniversary celebration (a.k.a. the “Big Birthday Bash”) began several months later. The event was highly satisfying for all who took part. Many visitors thanked the scientists for displaying their work and expressed the wish that open houses would be held regularly at the center. To view or download a program for the event, visit URL <http://walrus.wr.usgs.gov/125/>. ❄



**Eric Geist** uses computer simulations to show visitors how tsunamis form and move through the ocean and onto the shore. Photograph by **Francis Parchaso**.



**Wes Ward**, USGS Western Regional Geologist, describes for visitors the setting in which the USGS was created in 1879. Photograph by **Francis Parchaso**.



**Steve Walter**, of the USGS Earthquake Hazards Team, helps visitors determine how close they live to a major fault. Photograph by **Phil Stoffer**.



Actor **Earll Kingston** chats with a visitor after his performance of a one-act play about the USGS' second director, **John Wesley Powell**, and his exploration of the Grand Canyon. Photograph by **Phil Stoffer**.



Young visitor gets sidetracked by the railroad line adjacent to the Pacific Science Center (not used on weekends). Photograph by **Francis Parchaso**.

## Hurricane Research an Interest for Museum Exhibit Designers

By Jennifer Leigh Oates

Exhibit designers from the Museum of Science and Industry (MOSI) in Tampa, FL, recently met with scientists to learn more about hurricane research. The Centers for Ocean Sciences Education Excellence (COSEE) hosted the meeting, at which the exhibit designers met with professors from the University of South Florida (USF)'s College of Marine Science and an oceanographer from the U.S. Geological Survey (USGS). Ironically, the

meeting was held on the 12th anniversary of Hurricane Andrew, which struck Florida on August 24, 1992.

At the meeting, **Abby Sallenger** (USGS) used the USGS Hurricane and Extreme Storm Impact Studies Web site (at URL <http://coastal.er.usgs.gov/hurricanes/>) to describe the relevance of storm research. Members of COSEE, USF, and MOSI were blown away by the devastation shown in aerial photographs taken shortly after the

passage of category 4 Hurricane Charley. The most impressive were a photomosaic of the new 450-m-wide breach in North Captiva Island, FL, and a color-infrared photograph of toppled trees that uniformly fell toward the Gulf of Mexico, from which the location of Hurricane Charley's landfall was easy to determine.

**Robert Weisberg**, a professor at USF, took advantage of the opportunity

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## Outreach, continued

(Hurricane Research continued from page 9)

to showcase model simulations for hurricane surges in the Tampa Bay area. He discussed how a storm surge depends on the direction from which the hurricane approaches.

**Mark Luther**, an associate professor at USF, discussed the importance of the Coastal Ocean Monitoring and Prediction System (COMPS) Web site (at URL <http://comps.marine.usf.edu/>). ❁



(Left to right) **Abby Sallenger, Bob Weisberg, and Mark Luther** present the most recent hurricane information to MOSI exhibit designers in a USF conference room overlooking Tampa Bay.

## USGS Hosts Science-Learning Session for Florida Teachers

The U.S. Geological Survey (USGS) hosted its first science-learning session for 67 educators from Bay Point Elementary Magnet School on September 10. Held at the USGS Center for Coastal and Watershed Studies in St. Petersburg, FL, the session was part of the center's participation in the St. Petersburg Mayor's Mentors & More Initiative. **Ann Tihansky** and **Don Hickey** discussed issues in the news concerning coral reefs and Florida's geology, including the formation of sinkholes. The objective of the science-learning sessions is for scientists to answer teachers' questions about science so that the teachers feel more comfortable answering students' questions and initiating science discussions in the classroom.

In April, St. Petersburg's **Mayor Rick Baker** announced the Mayor's Mentors &



(Left to right) **Willie Gore** (Bay Point Elementary assistant principal), **Ann Tihansky** (USGS hydrologist), **Don Hickey** (USGS physical scientist), and **Gaye Lively** (Bay Point Elementary principal).

More Initiative's successful recruitment of corporate and agency partners for all of the city's 27 elementary schools, 9 middle

schools, 5 high schools, and 3 secondary schools. The USGS and Echelon Real Estate selected Bay Point Elementary as their partner school because the school is known as the "Center for the Advancement of Science and Technology." The USGS will work with Bay Point Elementary to meet the needs of the students and teachers. The Mentors & More Initiative is intended to help students excel by augmenting the limited funds local schools have available and helping the community to get involved in improving education (see article in *Sound Waves*, September 2004). ❁



**Ann Tihansky** captivated the educators by showing photographs of sinkholes and video clips of divers swimming through underwater caves.

## USGS Science Presented at Shore and Beach Preservation Conference in New Orleans

By Brian Bossak

Two members of the U.S. Geological Survey (USGS) science team at the Center for Coastal and Watershed Studies in St. Petersburg, FL, recently braved the approach of Hurricane Ivan to speak at the American Shore and Beach Preservation Association (ASBPA)'s Annual Meeting



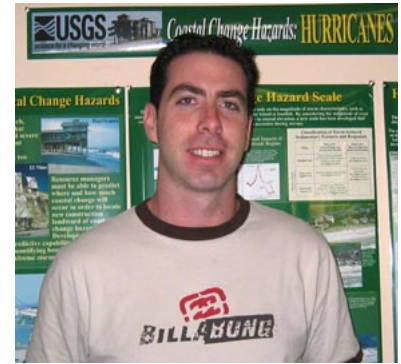
in New Orleans. Held September 13-15, the conference brought together coastal scientists, engineers, community planners, and others to discuss

**Tara Miller**

current efforts in shoreline stabilization and restoration, as well as threats to U.S. coastal areas.

**Brian Bossak**, a USGS Mendenhall Postdoctoral Fellow, presented a talk on the use of experimental lidar (light detection and ranging) data and a customized geographic-information-system (GIS) tool for modeling coastal change following hurricanes and nor'easters. The talk was well received, and several attendees approached afterward with suggestions, comments, and offers to collaborate on future projects.

Also well received was a talk on the National Assessment of Shoreline Change Project by **Tara Miller**, whose listeners were highly interested in the methodology and applications of **Tara's** USGS work.



**Brian Bossak**

It was gratifying to see the enthusiasm with which those involved in coastal issues view the work conducted by USGS scientists at St. Petersburg. Stay tuned for further updates on research conducted by these USGS team members! ❁

## Recent Meetings Attended by USGS Scientists Studying Deep-Water Corals

By Kathy Scanlon

**Kathy Scanlon**, of the U.S. Geological Survey (USGS) Woods Hole Science Center, attended the Oculina Closed Area and Deepwater Coral Researcher Workshop, sponsored by the South Atlantic Fishery Management Council, at Cape Canaveral, FL, August 31-September 3, 2004. The main goals of the workshop were to develop research and monitoring plans for (1) the Oculina Experimental Closed Area, a deep-water coral habitat off east-central Florida; and (2) deep-water coral and associated habitat off the Southeastern United States, in general. The meeting was cut

short when attendees were evacuated in preparation for Hurricane Frances. Plans are being made to finish the workshop at a later date.

**Page Valentine**, also of the USGS Woods Hole Science Center, attended the Deep-Sea Fisheries: Ecology, Economics, and Conservation symposium sponsored by the Ocean Life Institute of the Woods Hole Oceanographic Institution in Woods Hole, MA, September 12-14, 2004. With coauthor **Vince Guida**, of the National Oceanic and Atmospheric Administration (NOAA)'s National Marine Fisheries Ser-

vice laboratory at Sandy Hook, NJ, **Page** presented a poster entitled "Long-Term Changes in Canyon-Rim Fisheries Habitats: Deep-Sea Corals That Survive Trawling." In addition to an international group of research scientists, the symposium featured speakers from the fishing industry, conservation organizations, and government policymakers. Working groups met to discuss research and outreach needs and priorities. Other attendees from the USGS Woods Hole Science Center were **Kathy Scanlon**, **Julia Knisel**, and **Chris Polloni**. ❁



## Jim Estes Wins Shoemaker Award for Distinguished Achievement in Communication

U.S. Geological Survey (USGS) marine biologist **James A. Estes**, of the USGS Western Ecological Research Center field station in Santa Cruz, CA, has been selected as the sixth recipient of the Shoemaker Award for Distinguished Achievement in Communication. This award is given an-

nually by the USGS to honor a scientist who creates excitement and enthusiasm for science among non-scientists.

**Jim's** citation, available to USGS employees at URL [http://internal.usgs.gov/OUTREACH/shoemaker/a\\_winners.html](http://internal.usgs.gov/OUTREACH/shoemaker/a_winners.html), is reprinted below:



**Jim Estes**

**Dr. Estes** is well known internationally and nationally among his peers and the public for his outstanding research on sea otters and the key role they play in kelp-forest ecosystems. **Jim** has successfully communicated the fascinating story of the precipitous decline of sea otters in Alaska, the discovery that killer whales were preying on otters, and the subsequent chain reaction that resulted in the loss of entire kelp-forest ecosystems. First published in the prestigious journal *Science*, **Jim** went on to capture the public's attention around the world by telling his story through newspaper, magazine, radio and television media, including the *New York Times* and *Washington Post*, the Associated Press, Reuters, ENN News, *National Geographic* magazine, NBC Nightly News, MSNBC, National Public Radio, CNN, ABC, and the Canadian Broadcasting Company. **Jim** discussed the otter decline and historical human impacts on the Aleutian otters in a two-part production by Fox Television-New Zealand and Oregon

Public Television titled "Aleutians: Cradle of the Storms." **Jim's** story inspired *Los Angeles Times* environment writer **Marla Cone** to join **Jim** in Alaska to view and write about his research on Aleutian sea otters in depth, as a product for her Pew fellowship (also a Pew fellow, **Jim** is researching marine-reserve design). Her story for the *Los Angeles Times* appeared also in the *Philadelphia Inquirer*. **Jim** has enthusiastically communicated his story to all audiences, both young and old, leaving his legacy for even the youngest audience to ponder in a well-received, two-part cartoon story that appeared in *Ranger Rick Magazine*, a publication of the National Wildlife Federation.

**Jim's** career of more than 30 years of sea-otter research extends from the Aleutians to the southern end of the sea otter's range in California, where he seeks to discover why California's threatened sea-otter population is growing so slowly. When the spring census of 1999, led by the USGS, reported a 5-percent decline of adults and young adults since the previous year, another media frenzy regarding sea otters

was sparked. **Roger O'Neil** reported the population decline on the NBC Nightly News barely hours after **Estes** and his team made the final tally known. Since 1999, media coverage has been regular and **Estes** is regarded as a highly valued source, sought after by writers for his scientific perspective whenever a new revelation about California otters is made. One appreciative science writer praised **Jim's** clear and deep thinking and honest expression of facts. The news media continue to visit with **Jim** annually after the spring census for his elucidation of the status and trend of the California sea-otter population. In March 2003, **Jim's** exemplary work throughout his career for advancing the status of knowledge in the field of marine science was recognized with the Ed Ricketts Award, made by the Monterey Bay National Marine Sanctuary Research Activities Panel [see article in *Sound Waves*, April 2003]. The association with **Ricketts** as a communicator is apt for **Jim**, who inspires an interest in the marine world in everyone he touches. ❁

## Shoemaker Awards for *Sound Waves*, "Crater Lake Revealed," "Glaciers: Alaska's Rivers of Ice," and "Is a Powerful Quake Likely to Strike in the Next 30 Years?"

Four publications related to coastal and marine research have won 2004 Shoemaker Awards. *Sound Waves—Coastal Science and Research News from Across the USGS* won a Shoemaker Award for Excellence in Internal Communication, a new category established this year to recognize efforts to convey scientific, operational, or administrative information to USGS employees in a clear, concise, and timely manner.

Published online since 1999, this monthly internal newsletter reports on coastal and marine research and related activities conducted by USGS personnel around the Nation. The awardees are **Helen Gibbons, Trent Faust, George Havach, Susan Mayfield, Sara Boore, Joy Geiselman, Barbara Lidz, Gaye Farris, Gloria Maender, and Ellen Mecray. Jolene Shirley**, who recently began serving as the

Web layout editor for *Sound Waves*; **Terry Bruns**, who reviews all the articles; and **Rob Wertz**, who proofreads each issue online, also deserve credit for the newsletter, which can be viewed at URL <http://soundwaves.usgs.gov/>.

"Crater Lake Revealed" (USGS Geologic Investigations Series Map I-2790) won a Shoemaker Award for Communica-

(*Shoemaker Awards continued on page 13*)

(Shoemaker Awards continued from page 12)

tion Product Excellence in the print/poster category. This product reveals the depths of Oregon's Crater Lake, which fills part of a caldera formed approximately 7,700 years ago by the eruption and collapse of a 12,000-ft-high volcano called Mount Mazama. Recently, the lake bottom was mapped with a high-resolution multibeam echo sounder originally developed for sea-floor mapping. The new bathymetric survey provides a detailed view of the lake floor from its deepest basins virtually to the shoreline. Using geographic-information-system (GIS) applications, the bathymetry data were visualized and analyzed to shed light on the geology, geomorphology, and geologic history of this area, where future eruptions could threaten people and facilities, including the nearly 500,000 annual visitors to Crater Lake National Park and the major transportation and utility corridor east of the Cascade Range. Awardees are **David Ramsey, Peter Dartnell, Charles Bacon, Joel Robinson, James Gardner, and Jane Ciener**. The product can be viewed online at URL <http://geopubs.wr.usgs.gov/I-map/i2790/>.

"Glaciers: Alaska's Rivers of Ice" won a Shoemaker Award for Communication Product Excellence in the audio-visual category. This DVD contains about 1 1/2 hours of spectacular video footage of the glaciers of Alaska, plus a narration that explains the components and complexities of the glacier environment, a photo glossary of approximately 100 terms that provide a common vocabulary for all who view the DVD, and graphics that clearly describe and amplify critical concepts in the narration. Targeted at the general public—especially 12- to 18-year-olds—the DVD offers a comprehensive introduction to glaciers and shows that glaciers, a



Shoemaker Award winners from the Western Coastal and Marine Geology Team pose for a photograph after the Western Region Awards Ceremony, held October 13, 2004, in Menlo Park, CA. (Left to right) **Helen Gibbons, Stephanie Ross, and Pete Dartnell**.

crucial part of the Earth environment, are both sensitive to and predictive of climate change. The awardees are **Bruce F. Molnia, E.J. McFaul, and Ralph LaBarge** (of Alpha DVD). "Glaciers: Alaska's Rivers of Ice" was released by Alpha DVD as part of its DVD International's Learning Series and is currently available from Amazon.com.

"Is a Powerful Quake Likely to Strike in the Next 30 Years?" (USGS Fact Sheet 039-03) won a Shoemaker Award for Communication Product Excellence in the print/report category. This publication was created as one way to inform the nearly 7 million people living in the greater San Francisco Bay region of the latest scientific evidence and information on the earthquake hazard in the region. It is written in nontechnical language and aims not

only to state findings, such as earthquake probabilities on individual faults, but also to explain what these findings mean and how scientists arrived at their conclusions. The overall goal is to stimulate the public and policymakers to further prepare for the powerful quakes that are certain to strike the region in the future. The awardees are **Andrew J. Michael, Stephanie L. Ross, Robert W. Simpson, Mary Lou Zoback, David P. Schwartz, Michael L. Blampied, Peter H. Stauffer, James W. Hendley II, Susan Mayfield, and Sara Boore**. The product can be viewed online at URL <http://geopubs.wr.usgs.gov/fact-sheet/fs039-03/>.

USGS employees can read about these and other Shoemaker Awards on an internal Web site at URL <http://internal.usgs.gov/OUTREACH/shoemaker/>. ❁

## Shifting Baselines Contest—the Truth About Coral-Reef Decline

By Jennifer Leigh Oates

**Gene Shinn**, from the U.S. Geological Survey (USGS) Center for Coastal and Watershed Studies in St. Petersburg, FL, placed second in the Shifting Baselines photo and caption contest on August 2. Nearly 100 entries from 18 countries were

submitted to the contest.

The set of three photos entered by **Gene**, titled "Florida Corals (1959-98)," show a composite coral head consisting of two species of brain coral and one star coral. By 1988, the star coral had eroded

away, and by 1998 the once-large coral head was dead and encrusted with gorgonian corals.

**Craig Quirolo's** photograph "Corals (1994-2003)" won first place. **Craig** is a

(*Shifting Baselines continued on page 14*)

## Awards, continued

(Shifting Baselines continued from page 13)

cofounder of Key West's Reef Relief organization. His photos demonstrate how a 300-year-old coral colony disappeared in less than a decade.

Shifting Baselines is not an action group but rather a partnership between ocean conservation and Hollywood to help bring attention to the severity of ocean decline. Nineteen partner groups, including the Ocean Conservancy, Scripps Institution of Oceanography, and the Surfrider Foundation, sponsor Shifting Baselines. For more information about the photo contest and to view some of the other finalists and winners, visit Shifting Baselines at URL <http://www.shiftingbaselines.org/news/photocont.html>. ❁



**Gene Shinn's** awarding-winning set of photographs. The black-and-white photograph, taken in 1959, shows a composite head consisting of two species of brain coral and one star coral. In 1988, the star coral at left has eroded away, and by 1998 the head is dead and encrusted with gorgonian corals. Note divers for scale.



## Staff and Center News

### National Marine Fisheries Service Regional Office to Become USGS Neighbor in St. Petersburg, FL

By Jennifer Leigh Oates

The National Marine Fisheries Service (NMFS) Southeast Regional Office headquarters will be moving to the University of South Florida (USF)'s campus in downtown St. Petersburg, FL, in early 2005. The NMFS is an agency of the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce.

"We look forward to the increased interaction between agencies when we become neighbors on campus," said **Lisa Robbins**, director of the U.S. Geological Survey (USGS) Center for Coastal and Watershed Studies, also located in downtown St. Petersburg.

**Robbins** presented an overview of the USGS Florida Integrated Science Centers (FISC) to approximately 27 NMFS employees during a "Lunch 'n' Learn" meeting. A NOAA representative will make a complementary presentation at a USGS "Lunch 'n' Learn" session before moving to the USF's St. Petersburg campus.

Most of the NMFS employees in attendance were biologists. NMFS employees were curious about possible partnerships with the USGS. In the past, NOAA has partnered with the National Aeronautics and Space Administration (NASA), the USGS, and the U.S. Army Corps of Engineers (USACE) to conduct airborne topographic lidar (light detection and ranging) mapping.

**Lisa Robbins** addresses a crowded conference room during a NMFS "Lunch 'n' Learn."



**Buck Sutter**, deputy regional administrator of the NMFS Southeast Regional Office, and **Lisa Robbins**, director of the USGS Center for Coastal and Watershed Studies.

NMFS scientists were interested in obtaining USGS maps and data sets.

The mission of the National Marine Fisheries Service is stewardship of the Nation's living marine resources. Through conservation and wise use, these resources and their habitat can be managed to benefit the Nation without jeopardizing options for the future. To find more information about the NMFS Southeast Regional Office, visit URL <http://sero.nmfs.noaa.gov/>. The Web site for NMFS headquarters in Washington, DC, is at URL <http://www.nmfs.noaa.gov/>. ❁



## Western Coastal and Marine Geology Team Welcomes New Mendenhall Postdoctoral Fellow

By Bob Rosenbauer

**Elena Nilsen** has joined the U.S. Geological Survey (USGS) Western Coastal and Marine Geology Team at its Menlo Park, CA, office as a Mendenhall Postdoctoral Fellow. She will be working with **Bob Rosenbauer** and the team's geochemistry group, including **Keith Kvenvolden** (emeritus), **Tom Lorensen**, **Fran Hostettler**, **Renee Takesue**, and **Jen Dougherty**. She will be also work closely with cosponsor **Kathy Kuivila**, of the USGS Water Resources office in Sacramento, CA. The focus of **Elena's** work is to assess the impacts of anthropogenic contaminants on microbial communities and organic-matter composition in west-coast estuaries, including San Francisco Bay, Monterey Bay, and Puget Sound.

**Elena** comes to the USGS from the University of California, Santa Cruz,

where she worked with professor of ocean sciences **Peggy Delaney** on issues of carbon cycling, nutrient dynamics, and anthropogenic impacts on estuarine ecosystems. She obtained her B.S. at the University of California, San Diego.

**Elena** officially set up shop on October 1 and has had a busy first couple of weeks. She survived the myriad personnel forms and immediately headed off to Sacramento to attend the Third Biennial CALFED Science Conference, then returned just in time to take part in **Tom Lorensen's** remotely-operated-vehicle (ROV) cruise to sample submarine oil seeps in the Santa Barbara Channel.

**Elena** is a native Californian with interests in water sports (surfing, swimming, diving, rowing, kayaking), running (having completed the San Francisco



**Elena Nilsen**

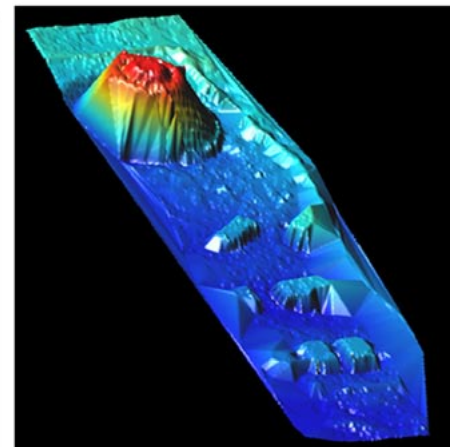
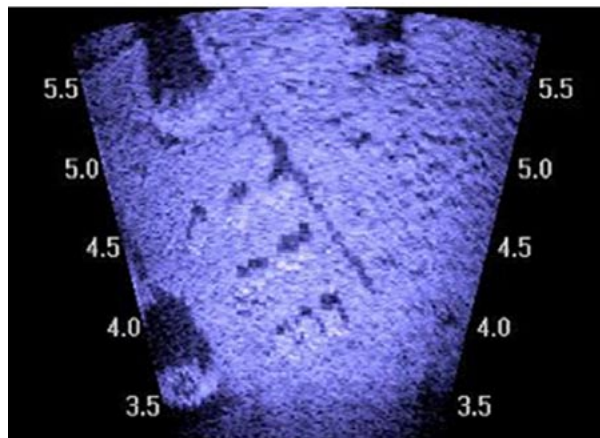
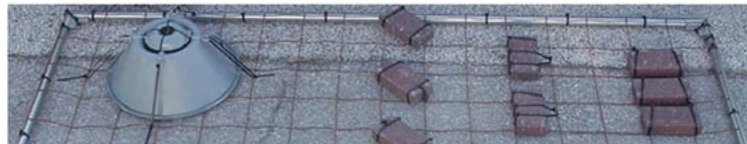
Marathon), foreign travel, and San Francisco Giants baseball. Her office is on the Menlo Park campus in Building 15, and she can be reached at (650) 329-4922 or [enilsen@usgs.gov](mailto:enilsen@usgs.gov).

## USGS Vessel Used to Test Counter-Terrorism Surveillance Equipment

By Jennifer Leigh Oates

Scientists from the University of South Florida (USF)'s Center for Ocean Technology (COT) recently demonstrated equipment for underwater counter-terrorism surveillance to U.S. Coast Guard observers in New Orleans. The equipment provides constant underwater surveillance with real-time video and three-dimensional sonar along piers, ship's hulls, and seawalls. **Captain Richard Young** of the U.S. Geological Survey (USGS) Center for Coastal and Watershed Studies in St. Petersburg, FL, accompanied the scientists aboard the USGS research vessel *G.K. Gilbert* during the July 29 demonstration in Tampa Bay.

"What comes back to us is not just a picture, but a continuous 3-D image we can rotate  
(Surveillance continued on page 16)



*Images of an object (in photograph, top) produced from data collected simultaneously with the Dual frequency IDentification SONar (DIDSON; image at lower left) and the Laser Line Scanner (lower right). The two types of data are gathered with a single pass. An interesting summary of DIDSON can be viewed at URL [http://www.apl.washington.edu/new\\_&\\_noteworthy/didson.html](http://www.apl.washington.edu/new_&_noteworthy/didson.html). Images provided by USF COT.*

(Surveillance continued from page 15)

and view from any angle,” said **Larry Langebrake**, COT’s director.

The system also provides high-resolution three-dimensional color images of what it scans, and a georeferencing system allows analysts to pinpoint the location of objects. The technology, developed with a grant from the Office of Naval Research, is extremely useful in helping port security officials to monitor underwater environments for suspicious objects and changes. The system can scan and image 3,000 ft of seawall in 10 minutes.

For more information about COT, visit URL <http://cot.marine.usf.edu/>.\*

*The research vessel G.K. Gilbert is used for diving, buoy servicing, data calibration, coring, sidescan-sonar and archeological surveys, remotely-operated-vehicle (ROV) deployment, red-tide tracking, fisheries science, at-sea education, and aquifer, mine, and spring research. Photograph provided by **Richard Young**.*

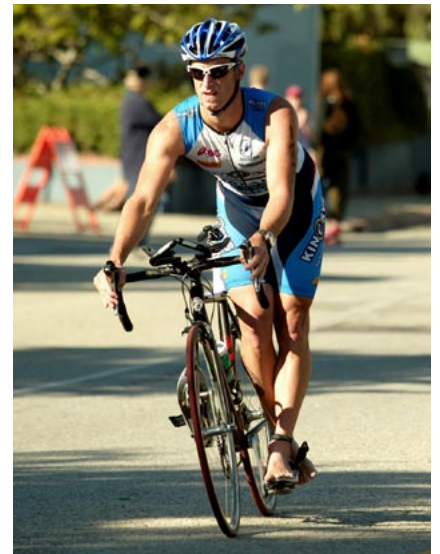


## Dave Reid Wins Triathlon in Santa Cruz, CA

**Dave Reid**, who works at the U.S. Geological Survey (USGS) Pacific Science Center in Santa Cruz, CA, won the 22nd Annual Santa Cruz Sentinel Triathlon on September 26. **Dave** completed the race—a 1.5-km ocean swim, 40-km bike ride, and 10-km run—in 1 hour, 58 minutes, and 19 seconds. **Dave** has competed several times in the annual race; this was his first victory. A detailed story about the event was published in the *Santa Cruz Sentinel* on September 27 and can be viewed online at URL <http://www.santacruzsentinel.com/archive/2004/September/27/sport/stories/02sport.htm>.

At the USGS, **Dave** works with **Cheryl Hapke** on the National Assessment of Coastal Change Hazards Project. They are currently using historical maps, lidar (light detection and ranging) data, and geographic-information-system (GIS) technology to calculate long-term (120-year) shoreline-change rates for the entire U.S. west coast.\*

***Dave** dismounts his bike while heading to the transition area before the running stage of the triathlon. Photograph by **Shmuel Thaler**/Santa Cruz Sentinel.*



## Publications

## New USGS Video Available Online: “Precipice of Survival: The Southern Sea Otter”

By **Gloria Maender**

Sea otters delight children and adults alike with their endearing faces and behavior, and even scientists find them fascinating creatures. California’s threatened sea otters are the focus of collaborative ongoing studies by U.S. Geological Survey (USGS) scientists and colleagues. Their story is the subject of

a new USGS video, entitled “Precipice of Survival: The Southern Sea Otter,” that can be viewed on demand online.

Half a million to perhaps several million sea otters are believed to have once ranged from central Baja California to Japan. The Pacific maritime fur trade, beginning in the

mid-1700s, reduced the sea-otter population to small groups scattered across their range. About a dozen remnant colonies survived at the time of their first being protected in the early 20th century, and with protection these colonies began to recover. In Califor-

*(Video continued on page 17)*



(Video continued from page 16)

nia, a colony of perhaps 50 or fewer animals remained off the rugged Big Sur coast in the early 20th century, and this colony has since expanded to about 2,500 animals along California's central coast.

The sea otter is a keystone organism of kelp forests. One of the sea otter's favorite foods is sea urchins, which feed on the kelp; thus, changes in the sea-otter population affect all levels of the kelp-forest ecosystem. Slow population growth and recent declines during the 1990s have been challenges facing the California sea otter. Scientists now know that elevated mortality is hindering the southern sea otter's recovery, and they are closely examining the causes of deaths in wild sea otters.

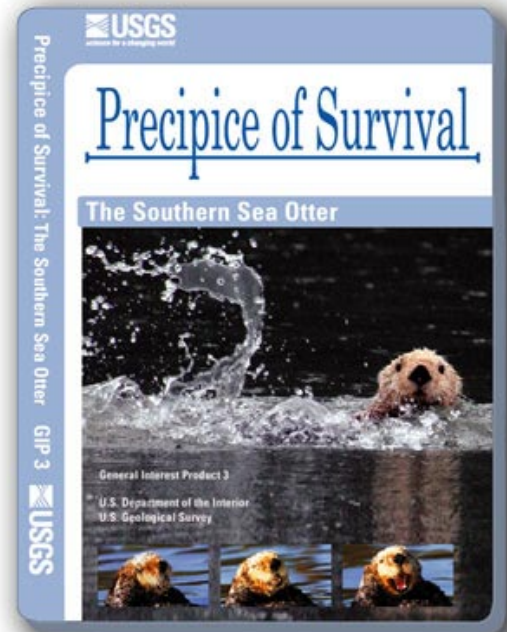
"Precipice of Survival: The Southern Sea Otter," USGS General Interest Product 3, is a 48-minute video that shows:

- How scientists survey and monitor wild sea otters
- How scientists capture wild sea otters, track their movements, and document their behavior

- How veterinarians surgically implant devices that will allow researchers to closely follow individual animals as they live and die in the wild
- How necropsies—animal autopsies—of fresh sea-otter carcasses tell the scientists the causes of death for some sea otters
- How captive sea otters provide additional insight into how sea otters make their living

The program was shot in high-definition video and produced by the USGS Western Ecological Research Center and the Western Region Office of Communications; it was produced and directed by **Stephen Wessells**.

To view the video online, visit the "Precipice of Survival: The Southern Sea Otter" Web page at URL <http://online.wr.usgs.gov/outreach/> and click on the "Video Stream" link. ❁



## New USGS Publication Reveals Human Influence on San Francisco Bay Floor

The U.S. Geological Survey (USGS) recently released "Shifting Shoals and Shattered Rocks—How Man Has Transformed the Floor of West-Central San Francisco Bay" (USGS Circular 1259), by **John Chin, Florence Wong, and Paul Carlson**. The new book takes readers beneath the waters of San Francisco Bay to see a bay floor greatly modified by humans since the California gold-rush days of the 1850s. Recent high-resolution mapping provides a detailed image of sandy dune fields, rocky pinnacles, and extremes in relief—much like features on dry land. The new map data reveal evidence of large-scale, long-lasting excavations dug in the 1910s and 1930s to provide fill to enlarge the Marina District in San Francisco and to create Treasure Island off the San Francisco-Oakland Bay Bridge. Rock pinnacles in western San Francisco Bay that lie in or adjacent to major shipping lanes have been lowered by blasting several times in the past. Depressions in the bay floor have served as economical, but rapidly filled, targets for disposal of construction and



*This view toward downtown San Francisco, featured on the new book's cover, shows a large container vessel passing beneath the Golden Gate Bridge as it enters San Francisco Bay. Photograph by **Michael F. Diggles**, USGS.*

other debris. Sand beds on the bay floor are a major resource that is mined for construction. The book includes a folded poster containing a three-dimensional image

of the bay floor, and a set of 3D glasses. The circular can be viewed online at URL <http://pubs.usgs.gov/circ/2004/c1259/>. ❁

## Richly Illustrated USGS Publication About Coastal Cliffs Along U.S. Shorelines

Coastal cliffs are a common landform on the west, northeast, and Great Lakes coasts of the United States, as well as within large estuaries. The land adjacent to coastal cliffs has been heavily developed along much of the coast, particularly in urban areas where the natural instability and progressive retreat of the cliffs pose a threat to life and property. The permanent loss of coastal land when cliffs collapse and retreat landward is an important national issue in coastal planning, management, and engineering. "Formation, Evolution, and Stability of Coastal Cliffs—Status and Trends" (U.S. Geological Survey [USGS] Professional Paper 1693), edited by **Monty Hampton** (USGS) and **Gary Griggs** (University of California, Santa Cruz), reviews the status of coastal cliffs along the shorelines of the conterminous United States and the Great Lakes. It includes articles on how coastal cliffs form and evolve, and how cliff retreat is measured. Maps, diagrams, and a wealth of photographs introduce



*Photograph taken just before the 1997-98 El Niño storms, looking northward along the approximately 30-m-tall seacliff at North Esplanade Beach in Pacifica, CA. The soft cliff shows signs of erosion, and a rip-rap seawall is being constructed at the cliff base to protect houses along the cliff edge. The seawall was not completed before the storms, and the cliff retreated more than 10 m. Most of the houses along the cliff were condemned and razed after the storm season.*

readers to coastal cliffs and bluffs in California, Oregon, Washington, New England, and the Great Lakes. Intended for a broad

audience, the new publication can be viewed online at URL <http://pubs.usgs.gov/pp/pp1693/>. ❁

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- Baldwin, W.E., Morton, R.A., Denny, J.F., Dadisman, S.V., Schwab, W.C., Gayes, P.T., and Driscoll, N.W., 2004, Maps showing the stratigraphic framework of South Carolina's Long Bay from Little River to Winyah Bay: U.S. Geological Survey Open File Report 2004-1013 [URL <http://pubs.usgs.gov/of/2004/1013/>].
- Baldwin, W.E., Morton, R.A., Schwab, W.C., Gayes, P.T., and Driscoll, N.W., 2004, Modern availability and historic supply of sediment along the inner-continental shelf offshore northeast South Carolina: Geological Society of America, Northeastern Section (39th Annual) and Southeastern Section (53d Annual) Joint Meeting, Tysons Corner, VA, March 25-27, 2004, Abstracts with Program, v. 36, no. 2, p. 132 [URL [http://gsa.confex.com/gsa/2004NE/finalprogram/abstract\\_70515.htm](http://gsa.confex.com/gsa/2004NE/finalprogram/abstract_70515.htm)].
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