USGS

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Fieldwork

Finding the Needle in a Big Haystack—Locating Surf Scoter Nests in the Northern Boreal Forest

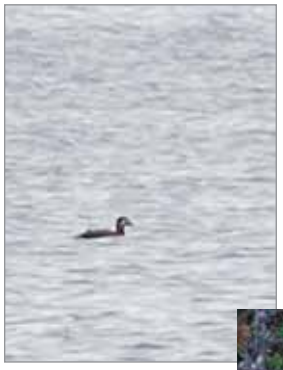
By John Takekawa

In a pioneering study, a team led by the U.S. Geological Survey (USGS) has tracked a surf scoter from its coastal wintering grounds in San Francisco Bay to its nest 2,000 mi away in the vast northern boreal forest of interior Canada. By marking individual surf scoters with satellite and radio transmitters while these sea ducks wintered in San Francisco Bay, the team was able to document the birds' spring migration from wintering grounds to breeding grounds.

"In migratory-bird studies, cross-seasonal research linking wintering and breeding areas is something of a Holy Grail," said **John Takekawa**, wildlife biologist and principal investigator with the USGS Western Ecological Research Center's San Francisco Bay Estuary Field Station in Vallejo, CA. "Many of these migratory species nest thousands of miles from where they spend the winter, and it is difficult to determine which group is from where."

Making such linkages may be vital to understanding alarming declines in sea duck numbers during the past few decades. Many sea ducks breed in northern boreal-forest and tundra areas and winter in marine environments. Degradation of their remote northern breeding habitats, possibly linked to global climate change, has been suggested by some researchers as a possible explanation for the decline in these species. At the same time, these ducks may be threatened by human activities in their major coastal wintering areas. The San Francisco Bay region supports the largest wintering population of surf scoters in the Pacific Flyway; however, it is also home to 8 million people, who outnumber surf scoters by 250 to 1.

*Surf scoters in the winter at San Francisco Bay. Photograph by **Dan Gaube**, USGS.*



*Satellite-marked surf scoter from San Francisco Bay on a lake near its nest (shown at right) in Canada. Photographs by **Matt Wilson**, USGS.*

*Northern boreal-forest habitat in interior Canada where scientists located a surf scoter from San Francisco Bay and its nest containing six eggs (at left). Photographs by **Matt Wilson**, USGS.*

Habitats in San Francisco Bay are impaired by pollutants, including mercury. Historically, mercury deposits were mined in the Coast Ranges and used for extraction of gold by placer miners in the Sierra Nevada during the Gold Rush era that began in 1849. Mercury accumulated in sediment that was eroded in the mining process and has since flowed downstream to be deposited in the bay. Surf scoters found in San Francisco Bay have elevated mercury levels, but little is known about the effects of this contaminant on their breeding success.

"Although surf scoters breed from Quebec to Alaska, our preliminary studies in 2003 showed that most birds marked with satellite transmitters in San Francisco Bay were distributed in a band a few hundred miles wide at the edge of the treeline from Great Slave Lake to Great Bear Lake in [Canada's] Northwest Territories," said USGS biologist **Susan De La Cruz**.

Last winter, partnered with the U.S. Fish and Wildlife Service (USFWS) and supported by the Calfed Ecosystem Restoration Program, **De La Cruz** led the capture and radio marking of 90 surf scoters to follow them to their nests. In mid-June 2005, the project came to fruition as **Matt**

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Want to e-mail your question to the USGS? Send it to this address: **ask@usgs.gov**

Fieldwork, continued

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Wilson, a USGS biologist and graduate student at the University of California, Davis; **Rod King**, a USFWS pilot-biologist; and USGS intern **Kenny Farke** tracked a satellite-marked bird to a lake 80 mi east of Yellowknife, Northwest Territories. After landing in a floatplane, they searched along the lakeshore until finally spotting the satellite-marked hen sitting on six eggs in a downy nest.

"The eggs were freshly laid within a day or two," reported **Wilson**, who used a tube to "candle" or determine the age of the incubating eggs. Samples from this nest and others like it will be tested to determine whether contaminants from urbanized southern wintering regions may be affecting the reproduction of migratory birds breeding in the north.

Along with this first step in documenting breeding effects, the team is working with biologists from the Washington Department of Fish and Wildlife, the Canadian Wildlife Service, Simon Fraser University, and the USGS Alaska Science Center, with support from the North American Sea Duck Joint Venture (see URL **http://www.seaduckjv.org**), to examine the breeding distribution of surf scoters from major Pacific coast wintering areas that extend from Mexico to British Columbia. With such cross-seasonal information, it may be possible to determine more reliably which wintering populations are vulnerable to emerging threats in the breeding areas, such as a proposed natural-gas pipeline along the Mackenzie River and development of extensive beds of oil sands in northern Alberta.

To learn more about this USGS surf scoter study, please visit URL **http://www.werc.usgs.gov/scoter/2005/**.

*Map of the more than 2,000-mi migration of a satellite-marked surf scoter from its wintering grounds in San Francisco Bay (red arrow) to its breeding grounds in Canada (yellow arrow). Modified from a graphic by **William Perry**, USGS.*

USGS Researchers Lead a Collaborative Effort for Further Investigation of the Deep Coral Reef at Pulley Ridge

By Kate Ciembronowicz and John Kucek

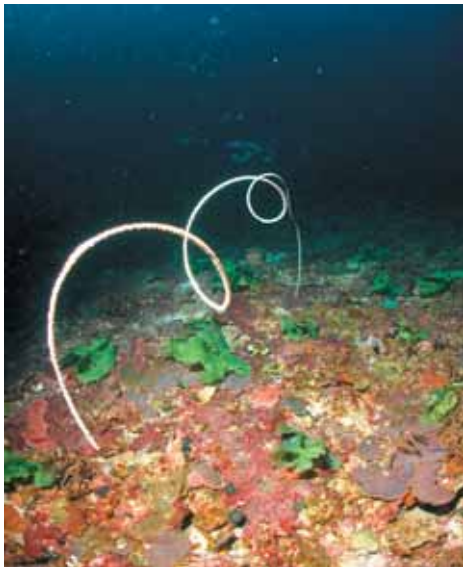
On June 22, researchers from the U.S. Geological Survey (USGS) and other organizations departed on the Florida Institute of Oceanography (FIO) research vessel *Suncoaster* to revisit what has been determined to be the continental United States' deepest known hermatypic (reef-building) coral community, situated on the southwest edge of the western Florida shelf (see article in *Sound Waves*, February 2005, at URL **http://soundwaves.usgs.gov/2005/02/research2.html**). Interest in this unique deep-water ecosystem launched a multidisciplinary flotilla of research vessels:

- the *Suncoaster*, which carried a one-person submersible and a remotely operated vehicle (ROV);
- the *Bellows* (FIO), which performed geophysical surveys;
- the *Tiburon* (Ocean Outreach, Inc.), which provided a base for deep-water scientific divers; and
- the *Irene C* (National Oceanic and Atmospheric Administration [NOAA]), which served as the support vessel.

This expedition made it possible to use multiple tools and technologies to conduct new investigations of the southern area of coral growth and to explore other benthic habitats in the region.

Dubbed the "Miracle Cruise" by chief scientist **Robert Halley** (USGS, St. Petersburg, FL), the expedition represented intense efforts to combine the resources and experience of knowledgeable organizations. Participants included researchers from FIO, NOAA, and Mote Marine Laboratory, as well as experts from the Florida Department of Environmental Protection (FDEP) and the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University, Corpus Christi. Deep Ocean Exploration and Research (DOER) Inc. was also a notable contributor, supplying the *DeepWorker* single-person submersible that proved to be invaluable for data collection. Even

Deep-water divers explore and photograph the benthic community at Pulley Ridge. Photograph by ***Tim Taylor*** *(captain of the research vessel* Tiburon*).*



Deep-diver photograph shows wire coral, Cirrhipathes leutkeni*, growing over typical live bottom at Pulley Ridge. Photograph by* ***Tim Taylor****.*

the National Geographic Society was involved, when Explorer-in-Residence **Sylvia Earle** (who is also the founder and chairman of DOER) joined the group to lead a team of submariners.

During the 10-day expedition, the research vessel *Suncoaster* launched six submersible dives, each lasting an average of 3 hours, and explored 10 ROV sites, despite some rough weather and an extremely strong current at the southern study area. On day 5, June 27, exploration at an ROV site north of the established coral zone revealed an intriguing area filled with dense patches of small calcareous tubeworms. None of the researchers had seen this type of tubeworm colony before, which made for an exciting find and a cruise highlight. On day 7, June 29, deep divers used mixed-gas technology and closed-circuit rebreathers to meet *DeepWorker* at depths greater than 65 m, coordinating the sampling efforts. The divers' ability to collect specific and fragile samples in such a remote environment was an invaluable addition to the expedition. Samples included hard corals, sponges, invertebrates, micromollusks, coralline algae, and red, brown, and green algae.

The research vessel *Bellows* team, working to the north, found ancient submerged shorelines at water depths of approximately 90, 80, and 70 m. These shoreline features harbor communities that consist of sponges, black corals, ahermatypic (non-reef-building) stony and soft corals, coralline algae, bryozoans, and mollusks. Dredged rock samples are suspected to be cemented oolitic grainstone and have been sent out for thin sections to confirm this identification.

Expedition participants included **Bob Halley** and **Kate Ciembronowicz** (USGS, St. Petersburg, FL); **Dann Blackwood** and **Richard Rendigs** (USGS, Woods Hole, MA), operating the ROV; **G.P. Schmahl** (NOAA), manager of the Flower Garden Banks National Marine Sanctuary; **David Guggenheim** (Harte Research Institute); **Sylvia Earle** (National Geographic Society, DOER Inc., Harte Research Institute); **James Culter**

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(Pulley Ridge Revisited continued from page 3)

(Mote Marine Laboratory); **Bret Jarrett**, **Al Hine**, **Beau Suthard** (University of South Florida); and **Ian Griffith**, leading the DOER engineering team.

Pulley Ridge is a series of north-south-trending drowned barrier islands stretching more than 100 km along the southwestern Florida shelf. At its southern part, the ridge hosts an unusual variety of zooxanthellate scleractinian corals, algae, and typically shallow-water tropical fishes not common to that depth or its low-light conditions.

For more information on Pulley Ridge, visit URL **http://coastal.er.usgs.gov/pulley-ridge/**.

Deep-diver photograph of live bottom at Pulley Ridge shows two species of Agaricia *coral growing with the green alga* Ventricaria ventricosa. *Photograph by* ***Tim Taylor****.*

Testing the DeepWorker *submersible from the research vessel* Suncoaster *in Bayboro Harbor before departure. Photograph by* ***George Guthro*** *(assistant engineer on the* Suncoaster*).*

Bob Halley *holds a large sample of* Anadyomene menziesii *collected by the deep-diver team. Photograph by* ***Dave Guggenheim****.*

California Sea Otters–2005 Survey Numbers Dip, But Overall Population Trend Remains Positive

By Gloria Maender

Observers tallied a total of 2,735 California sea otters during the 2005 spring survey, led by scientists at the U.S. Geological Survey (USGS). The 2005 total showed a 3.2-percent decrease in otters from the 2004 record high of 2,825. To assess overall population trends, however, little can be inferred from a single year's count. Instead, 3-year running averages are used to graph the data, as recommended by the U.S. Fish and Wildlife Service's Southern Sea Otter Recovery Plan. This approach reduces the influence of any anomalous counts in a given year.

"Despite the dip in this year's tally, the latest 3-year running average of the three most recent spring counts is up 8 percent over the previous average, to almost 2,700 sea otters," said survey organizer **Brian Hatfield**, a USGS biologist in California. "The meaning of the 2005 count will become clearer with additional years of averaged data points."

Greg Sanders, southern-sea-otter-recovery coordinator for the U.S. Fish and Wildlife Service, also noted that large numbers of sea otters were counted at the south end of the range during this survey. "Sea-otter range expansion into southern California is something that we will be examining closely over the next year."

The spring 2005 California sea-otter survey was conducted from May 6 to June 16, covering about 375 mi of California coast, from Half Moon Bay south to Santa Barbara. Overall viewing conditions were good to very good, comparable to condi-

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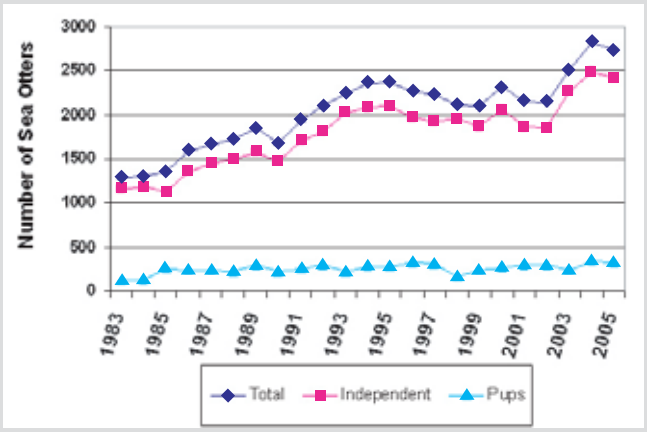
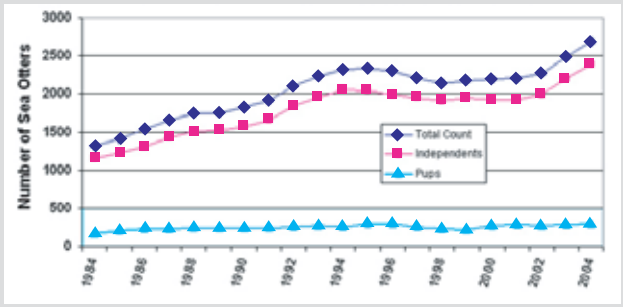
tions in 2004 and slightly less favorable than those in 2003. The spring survey is a cooperative effort of the USGS, the California Department of Fish and Game's Marine Wildlife Veterinary Care and Research Center, the Monterey Bay Aquarium, and many experienced and dedicated volunteers. The information gathered from spring surveys is used by Federal and State wildlife agencies in making decisions about the management of this small sea mammal.

A team of scientists from Federal and State agencies, universities, and the Monterey Bay Aquarium has been working collaboratively to determine causes of mortality in sea otters and the relative proportion of various threats. A USGS video about this research effort, "Precipice of Survival: The Southern Sea Otter," can be viewed online via video streaming at URL **http://online.wr.usgs.gov/outreach/**. Additional information about USGS sea-otter research is available at URL **http://www.werc.usgs.gov/otters/**.



*Graph on top shows number of sea otters counted in California spring surveys since 1983. To view additional data, go to URL **http://www.werc.usgs.gov/otters/ca-surveydata.html**.*



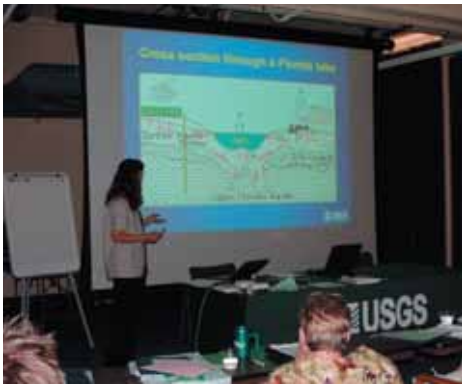
*Graph on bottom shows number of sea otters counted during spring surveys since 1983, plotted as 3-year running averages. (For example, the value for 2004 is the average of the 2003, 2004, and 2005 counts.) To view additional data, go to URL **http://www.werc.usgs.gov/otters/ca-survey3yr.html**.*

Partners for Ground-Water Education—Recent Teacher Workshops in Florida and California

By Vanessa Espinar

The U.S. Geological Survey (USGS) is partnering with the American Ground Water Trust (AGWT) to offer "Ground Water Institute for Teachers," a workshop that educates teachers about ground water and hydrology. The goal is to further the public's interest in and understanding of issues concerning water resources (see related article in *Sound Waves*, June 2005, at URL **http://soundwaves.usgs.gov/2005/06/outreach5.html**).

USGS scientists participate in these workshops by presenting their research, leading field trips, and providing educational materials. Teachers and educators learn about ground water's vital role in sustaining many aquatic ecosystems. Attendees also learn how to include the subject matter in their curriculum.



*USGS hydrologist **Amy Swancar** explains water-budget-calculation approaches to attendees at a teacher institute in St. Petersburg, FL.*

"Each workshop provides an increased understanding of ground-water-science concepts through a set of hands-on experiences that the teachers can take back to the classroom—as reality checks and exciting touchstones for their students to enjoy above and beyond the printed word in the curriculum textbook," said **Garret Graaskamp**, a ground-water specialist at AGWT. "Many examples of the ground-water issues and concepts presented at the workshops can be used as platforms for real-life projects and assignments in English, civics, statistics, physics, chemistry, and biology courses."

A workshop was held June 9-10 in St. Petersburg, FL, and another June 13-14 in Fresno, CA. The St. Petersburg workshop included field trips to Withlacoochee State Forest, Wall Springs Park, and a cave. Basic information about wells, cave ecology,

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and sources of ground-water contamination in Florida were some of the topics discussed. The Fresno workshop included a field trip to some of Fresno's water facilities. Geology basics, California water problems, and new water-pump technologies were some of the issues covered.

Even before the formal partnership, the USGS participated in the workshops that AGWT has held since 2000. "The purpose of the partnership is to expand the outreach and enhance the synergy of the previously informal arrangement between the AGWT and the USGS," **Graaskamp** said. "The partnership creates increased recognition and opportunities among the professionals of each organization to bring forward and showcase ground-water-science concepts in exciting forums that teachers can use to stimulate the awareness of their students to the importance of understanding, protecting, and sustaining our water resources." An attendee at the St. Petersburg workshop gave an example of how the partnership benefits teachers. "I have always felt that ground water is important. Now I feel I have the cool facts that will make students remember why it is important," said **Jessica Frankovitch**, an environmental science teacher from Florida's Crystal Springs Preserve.

One of the main goals of USGS involvement is to get USGS resources, science issues, and findings to the public. "Teachers are the best link to the public in terms of ground-water awareness," said **Ann Tihansky**, USGS hydrologist. Teachers attending the workshops receive a science message and a package of USGS materials that are consistent across the Nation. "The partnership is also a way to link teachers to all USGS resources, not just ground water," **Tihansky** said. Long-term goals are to hold these workshops in every State, to create a teacher network, and to obtain feedback from educators about what they need and what kinds of materials and formats they find most effective.

***Garth Gaddy**, chief of water operations for the Fresno Department of Public Utilities, explains aspects and issues of water supply and management in the city of Fresno, CA.*

Workshop topics range from general hydrology in a specific region to technical analysis of ground-water flow and applications of geophysics in ground-water studies. Commonly, local ground-water issues are incorporated into the program. "Ground water is an out-of-sight, out-of-mind kind of resource, so no one thinks about it. But it's a critical resource," **Tihansky** said.

Along with the Ground Water Institute for Teachers, the American Ground Water Trust sponsors several technical programs aimed at raising public awareness of ground-water issues and sharing expertise among ground-water professionals. These programs include:

- Public health, ground water, and wells;
- Land use and ground-water-management challenges in the Northeastern United States;
- Water policy and management—in-stream flow, stormwater, and aquatic habitats; and
- Ground-water models in the courtroom.

The AGWT also has hosted four separate conferences on Aquifer Storage and Recovery and is currently planning its fifth, ASR-5, to be held in Tampa, FL, in fall 2005. Since 2000, more than 30 USGS scientists nationwide have contributed to the AGWT's programs, sharing their expertise and familiarity with local ground-water topics. More than 20 USGS scientists have participated in the teacher institutes nationwide.

The teacher institute in Fresno, CA, included a field trip to Fresno water facilities.

The teacher institute in St. Petersburg, FL, included a field trip to a quarry (where this photograph was shot) and the opportunity to explore a cave.

Teachers from the Institute for Science Instruction and Study Visit the USGS Center in Woods Hole

By Bill Winters

In what has become a biennial tradition, a group from the Institute for Science Instruction and Study (ISIS) visited the U.S. Geological Survey (USGS) center in Woods Hole, MA, on March 12. **Gennaro Frumento** and **Scott Graves**, professors in the Science Education and Environmental Studies Department at Southern Connecticut State University and coordinators of the ISIS, brought 21 middle-school and high-school science teachers from throughout Connecticut to tour the center.

Established in 1985, the ISIS is an intense, 2-year, interdisciplinary program aimed at advanced-degree science teachers interested in bringing new discoveries, technologies, and ideas into the classroom. This was the fourth ISIS group to visit the USGS in Woods Hole since 1995. They had a tour of the facility, including a visit to GHASTLI (Gas Hydrate And Sediment Test Laboratory Instrument) and other instrumentation in the Geotechnical Laboratory used by **Bill Winters**, **Bill Waite**, **Dave Mason**, and **Lauren Gilbert**. The teachers were given a presentation on gas hydrates and USGS gas-hydrate field and laboratory programs. They also viewed video clips of a force-12 storm weathered by the Ocean Drilling Program's JOIDES *Resolution* and a giant piston-coring program conducted aboard the French Polar Institute's research vessel *Marion Dufresne* in the Gulf of Mexico (see related article in *Sound Waves*, September 2002, at URL **http://soundwaves.usgs.gov/2002/09/**).

Gennaro Frumento *and* ***Scott Graves*** *(second and third from left, back row), coordinators of the Institute for Science Instruction and Study (ISIS), and 21 middle-school and high-school science teachers from Connecticut visit the USGS Woods Hole Science Center to learn about gas hydrates and other areas of USGS research. Photograph by* ***Bill Winters****.*

The teachers were given numerous fact sheets, teacher's packets, and Web-related handouts. They also enjoyed learning about ongoing gas-hydrate work performed by **Debbie Hutchinson, Dave Twichell, Michelle Edwards,** and **VeeAnn Cross** as depicted in hallway posters. Because each of the teachers instructs about 100 to 130 students per day, the information gained during the Woods Hole visit potentially reaches vast numbers of students. We look forward to seeing the next group in 2 more years!

USGS Scientists Address International Visitors from Asia and Australia

U.S. Geological Survey (USGS) scientists, including two tsunami experts, presented information about USGS hazards research to 20 international visitors at the USGS center in Menlo Park, CA, on June 21. The visitors, from Australia and numerous countries in Asia, were hosted by the International Diplomacy Council—a San Francisco-based nonprofit organization that runs professional programs for emerging foreign leaders visiting the United States under the auspices of the U.S. State Department. The visitors saw presentations on:

- USGS earthquake research, including international work in Turkey and Japan and cooperative research between the United States and various Asian nations;
- USGS volcano-hazard research, including monitoring of active volcanoes, operation of volcano observatories, and participation in the Volcano Disaster Assistance Program (VDAP)—a mobile rapid-response program organized by the USGS and the U.S. Office of Foreign Disaster Assistance to reduce fatalities and economic losses in countries experiencing a volcano emergency;
- USGS landslide-hazard research, including landslide monitoring and emergency response; and
- USGS tsunami research (described below).

The tsunami-research presentations were given by two tsunami experts in the USGS Coastal and Marine Geology Program. Geophysicist **Eric Geist** explained the basics of tsunami generation and propagation, pointed out similarities and differences between the December 2004 and March 2005 tsunamis generated off Sumatra, and explained how tsunami effects can be mitigated by ocean-bottom

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(*International Visitors continued from page 7)*

sensors, tsunami-hazard mapping, and community planning. Oceanographer **Guy Gelfenbaum** described USGS participation in international scientific teams that surveyed the effects of the December 2004 tsunami in Sri Lanka, the Maldives, and Indonesia. The visitors were fascinated by his photographs of tsunami-stricken areas and expressed particular interest in his descriptions of earthquake-induced coastal subsidence in Sumatra and the permanent changes it caused to the coast, a topic that did not receive much media coverage.

The international visitors included representatives of national and local governments and service organizations, disaster-response coordinators, and crisis-management officials. They had come from Australia, Bangladesh, India, Japan, the Maldives, Malaysia, Nepal, Pakistan, the People's Republic of China, Singapore, Sri Lanka, and Thailand to participate in the U.S. State Department's International Visitor Leadership Program (IVLP). This program gives foreign visitors the opportunity to obtain firsthand knowledge about the United States—its people, policies, and culture—and to establish lasting professional relationships and learn about the intellectual and economic status of other countries. More than 200 current and former heads of state, 1,500 cabinet-level ministers, and many other distinguished world leaders in government and the private sector have participated in the International Visitor Leadership Program, including President **Hamid Karzai** of Afghanistan and Prime Minister **Tony Blair** of Great Britain. To learn more, visit Web pages posted by the International Diplomacy Council (URL **http://www.diplomacy.org/programs.html**) and the U.S. State Department (URL **http://exchanges.state.gov/education/ivp/**).

Southern Hospitality at Meeting on Interagency Science in the Suwannee River Basin

By Ann B. Tihansky

The U.S. Geological Survey (USGS) hosted the second Suwannee River Basin and Estuary Integrated Science Workshop at the Okefenokee Education and Research Center in Folkston, GA, on June 28 and 29. More than 65 scientists from more than 20 government and academic research groups participated. They are crafting a plan to coordinate water-resource studies within the Suwannee River basin, which is situated in both Georgia and Florida. An important mission of the plan is to include stakeholders from both States. USGS scientist **Ellen Raabe** said, "We want to bring scientists together to design a science plan that can be used to guide resource management throughout the entire basin. In order to support both economic development and environmental health within the basin, competing demands for water must be balanced."

Suwannee River Basin Workshop participants at lunch. Clockwise from center front: ***Lisa Robbins, Russ Hall, Brian Katz****, Folkston* ***Mayor Dixie McGurn, Ellen Raabe****, and* ***Robin Schrock*** *(all but the mayor are from the USGS).*

Recognizing the need to coordinate research efforts basin-wide, the Suwannee Basin Interagency Alliance held a conference in April 2001 in Live Oak, FL. In 2004, the USGS hosted a Suwannee River Basin and Estuary Integrated Science Workshop at Cedar Key, FL (see article in *Sound Waves*, December 2004/January 2005, at URL **http://soundwaves.usgs.gov/2005/01/meetings4.html**). This year, USGS organizers **Brian Katz** and **Ellen Raabe** selected Folkston, GA, for the meeting location because of its proximity to the Okefenokee Swamp, the headwaters of the eastern Suwannee River. The workshop focused on developing and reviewing the interagency science plan,

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identifying ways to integrate interstate science and management of resources, and developing Web links to make research and data available to all involved. The 2-day conference included formal presentations and breakout discussion sessions focused on detailed topics such as modeling, water supply, water quality, and data management.

The sleepy town of Folkston is known as the gateway to the Okefenokee Swamp. The workshop was held at the newly created Okefenokee Education and Research Center (OERC) and was cosponsored by the USGS, the U.S. Department of Agriculture, the University of Florida, the University of Georgia, the South Georgia Regional Development Center, the Suwannee River Water Management District, the U.S. Fish and Wildlife Service, and the Georgia Environmental Protection Division.

*Folkston **Mayor Dixie McGurn** takes lunch orders from USGS participants **Lisa Robbins** and **Russ Hall**.*

Southern hospitality included fresh blueberries and home-baked cookies for session breaks and a traditional "low-country boil" dinner hosted by the Okefenokee National Wildlife Refuge. Seven watermelons donated by the South Georgia Regional Development Center and the Natural Resources Conservation Service of Georgia were raffled off to lucky workshop participants. The final day of the conference included an enthusiastic address by **Ms. Dixie McGurn**, mayor of Folkston. **Dixie's** southern hospitality went beyond arranging a place large enough to accommodate the workshop group for lunch; she took everyone's orders as well!

***Mike Holmes** (USGS) is a proud winner in the watermelon raffle.*

To learn more about the meeting and science in the Suwannee River Basin, please visit URL **http://gulfsci.usgs.gov/suwannee/meetings/folkston/.**

Fish Habitat a Common Theme at USGS-NOAA Symposium in Santa Cruz, CA

U.S. Geological Survey (USGS) and National Oceanic and Atmospheric Administration (NOAA) scientists at neighboring facilities in Santa Cruz, CA, met to share research information at an all-day symposium on July 8. The morning session took place at the USGS Pacific Science Center, and the afternoon session at the Santa Cruz Laboratory, a component of the Southwest Fisheries Science Center of NOAA's National Marine Fisheries Service (NMFS). The two facilities are less than a mile apart. Center directors **Sam Johnson** (USGS) and **Churchill Grimes** (NMFS) arranged the symposium to give the two groups of researchers an opportunity to meet and share information about their work and to encourage future interactions and collaboration.

Scientists from each center gave short (15-20 minute) presentations about their research in a program organized by **Guy Cochrane** (USGS) and **David Boughton** (NOAA). Topics ranged from sea-floor mapping and sediment dynamics to salmon ecology and molecular genetics, with sea-floor fish habitat being a common theme. **Kathleen Donahue** (USGS) assisted in organizing the meeting, which included a morning mixer before the symposium and a social hour afterward. The day was productive and fun, and plans are underway to make the symposium an annual event.

New USGS Fact Sheet About Landslides Delivering Slope Material to Nearshore Waters on California's Big Sur Coast

Landslides are common along the rugged Big Sur coast in central California, where they frequently damage the popular Coast Highway and may impact nearshore marine life. To assist State and Federal agencies in managing this coastline, U.S. Geological Survey (USGS) scientists **Cheryl Hapke** (Kingston, RI) and **Krystal Green** (Santa Cruz, CA) have been studying the rates at which material erodes from Big Sur slopes and enters the waters of the adjacent Monterey Bay National Marine Sanctuary. They recently published "Rates of Landsliding and Cliff Retreat Along the Big Sur Coast, California—Measuring a Crucial Baseline" (USGS Fact Sheet 2004-3099), which describes some of their work. Using computer analyses of aerial photographs taken over three short time intervals between 1976 and 2001, the scientists calculated vertical changes in topography, or "material-loss rate," within specific landslides over time. Their results indicate wide variations in net loss rates along the coast, with higher loss rates in areas of weaker rocks and

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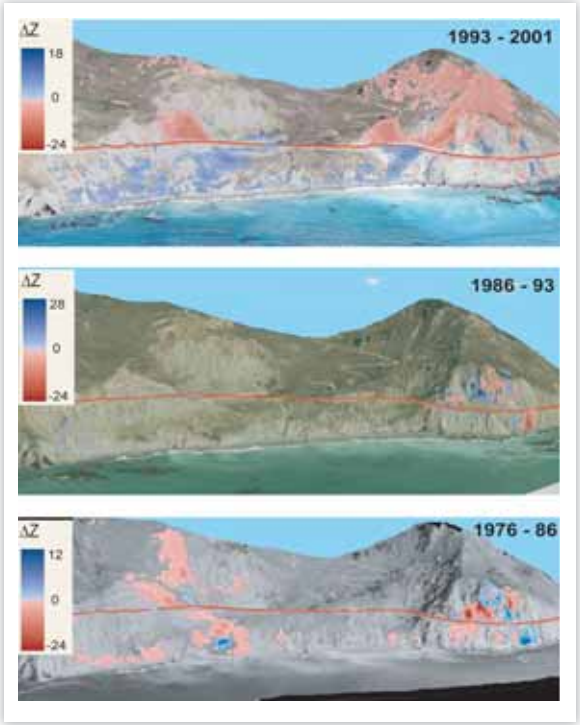
during periods of higher rainfall. Their studies of sediment erosion and deposition along the Big Sur coast—conducted in cooperation with the California Department of Transportation (Caltrans), the Monterey Bay National Marine Sanctuary, and the University of California, Santa Cruz—will help State and Federal agencies design coastal-management plans to minimize the environmental impacts of landslides and highway maintenance, while preserving the beauty and protecting the natural resources of this evolving coastline. The new Fact Sheet is available online at URL **http://pubs.usgs.gov/fs/2004/3099/**.

*Landslides at Big Slide (nearest scarp) and Pitkins Curve (rocky headland) are among those studied in detail by USGS scientists **Hapke** and **Green**.*



This series of images of the Big Slide-Pitkins Curve landslide area, taken from the new Fact Sheet, shows were material has been eroded (red) or deposited (blue) by landslide movement during three time intervals from 1976 to 2001. Material loss rates are derived by dividing the change in elevation (ΔZ, in yards) by the length of the interval (in years).

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