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Fieldwork

Sea Turtles in the Dry Tortugas: Tracking Movements of Endangered Species in Florida's Coral-Reef Habitats

By Kristen Hart

In 1513, Spanish explorer **Ponce de León** discovered a small group of islands about 100 km west of today's Key West, Florida, which he named "Las Tortugas" for the abundant sea turtles living there. Soon the islands became known as the Dry Tortugas ("Dry" was added to alert mariners to the lack of freshwater), and today, all five species of sea turtles in the islands are on the U.S. Endangered Species list. To assist with broad conservation goals of the National Park Service and Federal recovery plans for these species, U.S. Geological Survey (USGS) scientists are investigating sea turtles and their habitats in Dry Tortugas National Park.

Kristen Hart and **Keith Ludwig** of the USGS Florida Integrated Science Center (FISC) office in St. Petersburg participated in two research cruises in 2008 to study patterns of habitat use by endangered sea turtles in and around the National Park. The cruises were conducted in May and August 2008 on board the merchant vessel (M/V) *Fort Jefferson*. **Hart** and **Ludwig** used the ship's tender (the *Livingston*, a 14-ft center-console catamaran skiff with a 25-horsepower motor) as a workboat.

***Kristen Hart** releasing a juvenile green sea turtle after workup and tagging, August 2008, Dry Tortugas National Park. Photograph by **Keith Ludwig**.*

*Set of loggerhead sea turtle tracks, called a "crawl," on East Key, May 2008, Dry Tortugas National Park. Photograph by **Kristen Hart**.*

*Female loggerhead sea turtle nicknamed "Bertha" returning to sea after being tagged with a satellite tag (top of carapace) and an acoustic tag (rear carapace) on East Key, May 2008, Dry Tortugas National Park. Photograph by **Kristen Hart**.*

Dry Tortugas National Park, part of the Florida coral-reef tract, harbors both soft-bottom (seagrass) and hard-bottom (coral and sponge) habitats that are important for several species of sea turtles. In January 2007, the designation of a new Research Natural Area in the Park set aside 46 mi^2 as a no-take preserve, presenting an opportunity to address the efficacy of the Research Natural Area in protecting endangered species and their habitats.

Hart's research effort focuses on quantifying patterns of sea turtle habitat use; her team employs capture-recapture and satellite- and acoustic-tracking techniques to determine the amount of time endangered sea turtles spend in and

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Sound Waves

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around the various "no fishing" zones of Dry Tortugas National Park. The team also samples turtles for genetic material and will use molecular genetic methods to reveal connections between Dry Tortugas sea turtles and others sampled previously at various locations throughout south Florida and the Caribbean.

This sea turtle project complements a high-resolution underwater digital-imaging project led by **Dave Zawada** of the FISC St. Petersburg office. **Zawada** and **Hart** will work together to identify areas of Dry Tortugas National Park that are frequently used by tagged sea turtles, and then they will characterize the benthic (sea floor) cover in those areas, using the USGS Along-Track Reef-Imaging System (ATRIS; see related *Sound Waves* articles at URLs **http://soundwaves.usgs.gov/2008/03/fieldwork2.html** and **http://soundwaves.usgs.gov/2005/09/fieldwork4.html**). **Zawada** will also lead an effort to characterize bottom cover in areas of the Park currently classified as "unknown," as well as along the boundaries of the Research Natural Area.

*One of the smallest juvenile green turtles captured thus far, August 2008, Dry Tortugas National Park. Photograph by **Kristen Hart**.*

During fieldwork conducted in October 2007 (also aboard the M/V *Fort Jefferson*), **Hart** and **Ludwig** logged the locations of sea turtle sightings. **Hart** used this record to plan the team's in-water capture efforts for 2008, since there were several "hotspots" where sea turtle sightings were concentrated. At present, **Hart's** record of Dry Tortugas sea turtle sightings consists of 105 locations representing 105 individual turtles observed in Park waters from October 2007 through August 2008.

In May 2008, **Hart** and **Ludwig** tagged their first Dry Tortugas sea turtles, three female loggerheads (*Caretta caretta*) nesting on East Key. Loggerheads are listed as Threatened under the Endangered Species Act (see URL **http://www.nmfs.noaa.gov/pr/species/turtles/**), and Dry Tortugas loggerheads represent a genetically distinct subpopulation. The turtles were outfitted with satellite tags capable of relaying daily latitude and longitude locations to a central computer, as well as acoustic tags that transmit to a stationary array of acoustic listening stations deployed around Dry Tortugas National Park. The satellite tags relay data only when they are out of the water, which occurs when the tagged turtles are at the water surface or on land. In contrast, the acoustic tags relay data only when submerged; their placement on the carapace assures that the tags are submerged when the turtles come to the surface to breathe as well as when they are feeding or resting underwater (where they actually spend most of their time). The acoustic tag's signal is recorded any time a tagged turtle passes within range of an acoustic receiver, of which there are approximately 85 within Dry Tortugas National Park. The battery life of satellite tags should allow them to transmit daily positions of sea turtles for as long as 1 year, whereas the battery configuration of acoustic tags should allow them to transmit considerably longer, for as long as 4 years. Since May, **Hart** has been satellite-tracking the movements of the three tagged loggerheads within, around, and outside the boundaries of the Park on a daily basis. These three individuals are the first

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*Juvenile green sea turtle nicknamed "Jefferson," captured August 2008 in the moat at Fort Jefferson, Dry Tortugas National Park. Photograph by **Kristen Hart**.*

sea turtles from Dry Tortugas National Park ever to be equipped with such tags.

In August 2008, **Hart** and **Ludwig** initiated their in-water capture efforts and caught 26 juvenile sea turtles of two different species—23 green turtles (*Chelonia mydas*) and 3 hawksbills (*Eretmochelys imbricata*)—using dip-net and hand-capture methods. In the Florida region, both green turtles and hawksbills are listed as Endangered under the U.S. Endangered Species Act. None of the turtles captured had fibropapillomas—fibrous, lobe-shaped tumors that affect other populations of green turtles in coastal areas adjacent to peninsular Florida. With a limited number of tags on hand, **Hart** chose to outfit all three hawksbills with satellite tags and two with acoustic tags in order to track their movements around the study site. (Juvenile hawksbills have never before been satellite-tracked in U.S. waters.) She also placed an acoustic tag on one of the juvenile green turtles. By tracking the movements of several different species of sea turtles, **Hart** can determine turtle habitat-use patterns and pinpoint particular resources in Dry Tortugas National Park that may serve to sustain the local sea turtle populations; loggerheads forage on such food items as spiny lobsters and crabs, hawksbills consume sponges, and green turtles graze on seagrasses and marine algae.

Although the ecology and movements of sea turtles using mainland U.S. nesting beaches are relatively well known, little is known about the habitat requirements or movements of juvenile sea turtles of any species in their aquatic environment. Globally, only a handful of studies have ever focused on satellite-tracking of hawksbills, and most of those have targeted nesting hawksbills. Similarly, knowledge of the ecology and movements of adult sea turtles using remote U.S beaches, such as those in the Dry Tortugas, is also limited. Thus, the tracking of loggerheads and hawksbills will provide extremely useful information for Federal recovery plans for these endangered species. In the future, **Hart** will also track green sea turtles in Dry Tortugas National Park to gain a more thorough understanding of their use of the seagrass resources in and around the Park.

Through this research, the USGS will provide a more comprehensive understanding of endangered sea turtles' use of National Park resources over time. Such information will be instructive in forming management strategies that benefit endangered species and the habitats and resources upon which they rely.

To learn more about the conservation status of sea turtles in the United States, visit the "Marine Turtles" Web site hosted by the National Oceanic and Atmospheric Administration (NOAA) Marine Fisheries Service's Office of Protected Resources at URL **http://www.nmfs.noaa.gov/pr/species/turtles/**. To learn more about **Hart's** studies of sea turtles, visit URL **http://sofia.usgs.gov/people/hart.html**.

***Kristen Hart** releasing a satellite-tagged hawksbill sea turtle, August 2008, Dry Tortugas National Park. Photograph by **Keith Ludwig**.*

Most Alaskan Glaciers Retreating, Thinning, and Stagnating, Says Major USGS Report

By Catherine Puckett and Bruce Molnia

Scientists estimate that Alaska contains more than 100,000 glaciers—including about 60 active and former tidewater glaciers—which cover approximately 75,000 km^2, or about 5 percent of the State.

According to a new book published by the U.S. Geological Survey (USGS), most glaciers in every mountain range and island group in Alaska are undergoing significant retreat, thinning, or stagnation, especially glaciers at lower elevations. In places, these changes began as early as the middle of the 18th century.

Although a handful of Alaska's large glaciers are, surprisingly, advancing, more than 99 percent of them are retreating. In the past decade, Alaska's coastal glaciers have added as much (or more) meltwater to the global ocean as the ice sheets of Greenland or Antarctica, making these glaciers a significant factor in global sea-level rise.

Glaciers of Alaska, authored by USGS research geologist **Bruce Molnia**, presents a comprehensive overview of the state of Alaskan glaciers at the end of the 20th century and beginning of the 21st century. **Richard Williams, Jr.**, an emeritus senior research glaciologist with the USGS, said the 550-page volume will serve as a major reference work for glaciologists studying glaciers in Alaska for decades to come.

The report uses a combination of satellite images, vertical aerial photographs (black-and-white and color-infrared photos taken from airplanes, looking straight down), oblique aerial photographs (color photos taken from the air at an angle, such as most regular photos), and maps, supported by the scientific literature, to document the distribution and behavior of glaciers throughout Alaska.

The author concludes that, because of the vast areas encompassed by the glaciated regions of Alaska, satellite remote sensing provides the only feasible means of monitoring changes in glacier area and in position of termini—the ends of glaciers—in response to short- and long-term changes in the marine and continental climates of Alaska.

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August 1941 photograph of Muir Glacier in Glacier Bay National Monument, Alaska, showing the lower reaches of Muir Glacier—then a large, tidewater calving valley glacier—and its tributary, Riggs Glacier (upper right). For nearly 2 centuries before 1941, Muir Glacier had been retreating; in places, a thickness of more than two-thirds of a mile of ice had been lost. Photograph courtesy of the National Snow and Ice Data Center and the Glacier Bay National Park and Preserve Archive.

This August 1950 photograph documents the significant changes that occurred during the 9 years between photographs A and B. Muir Glacier has retreated more than 2 mi, exposing Muir Inlet, and thinned 340 ft or more; however, it still is connected with tributary Riggs Glacier. Photograph courtesy of the Glacier Bay National Park and Preserve Archive.

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Alaskan glaciers occur in 11 mountain ranges, one large island, one island chain, and one archipelago. Details about the recent behavior of many of Alaska's glaciers are contained in this richly illustrated book, with multiple photographs and satellite images, as well as hundreds of aerial photographs taken by **Molnia** during his more than 4 decades of fieldwork in Alaska.

Three other USGS glaciologists authored two sidebar sections of the book: "Columbia and Hubbard Tidewater Glaciers," by **Robert M. Krimmel**; and "The 1986 and 2002 Temporary Closures of Russell Fiord by the Hubbard Glacier," by **Bruce F. Molnia**, **Dennis C. Trabant**, **Rod S. March**, and **Robert M. Krimmel**. A third section, "Geospatial Inventory and Analysis of Glaciers: A Case Study for the Eastern Alaska Range," was authored by **William F. Manley**, Institute of Arctic and Alpine Research (INSTAAR), University of Colorado.

This book (USGS Professional Paper 1386-K), which is available in print and online at URL **http://pubs.usgs.gov/pp/p1386k/**, is the eighth chapter to be published in the Satellite Image Atlas of Glaciers of the World series. More than 100 glaciologists from the United States and other nations have collaborated with the USGS to produce this series, which will eventually contain 11 chapters. (See USGS Fact Sheet 2005-3056 at URL **http://pubs.usgs.gov/fs/2005/3056/**.)❁

This August 2004 photograph further documents the significant changes that occurred during the 63 years between photographs A and C and during the 54 years between photographs B and C. Muir Glacier has retreated out of the field of view and is now nearly 5 mi to the northwest. Riggs Glacier has retreated as much as 2,000 ft and thinned by more than 800 ft. Note that dense vegetation has developed. Also note the correlation between Muir Glacier's 1941 thickness (see photograph A) and the trimline—the nearly horizontal line on the mountainside on the left side of the 2004 photograph, which indicates the past height of the glacier. Photograph by ***Bruce Molnia****.*

This August 1980 photograph of Muir Glacier—taken from a ship in Muir Inlet, Glacier Bay National Park and Preserve, St. Elias Mountains, Alaska—shows the nearly 200-ft-high retreating tidewater end of Muir Glacier, with part of its face capped by a few angular pinnacles of ice, called seracs. Note the icebergs in the ship's wake in the lower right side of the photograph. The glacier's terminus is less than a mile from the landward end of Muir Inlet. Photograph by ***Bruce Molnia****.*

Photograph taken in September 2003; in the 23 years between photographs, Muir Glacier has retreated more than a mile and ceased to have a tidewater terminus. Since 1980, Muir Glacier has thinned by more than 600 ft, permitting a view of a mountain in the center of the photograph with a summit elevation higher than 4,000 ft. A reexamination of the 1980 photograph shows that the summit of this mountain was visible but blended in with adjacent clouds. Photograph by ***Bruce Molnia****.*

Genetics Provides Evidence for the Movement of Avian Influenza Viruses from Asia to North America via Migratory Birds

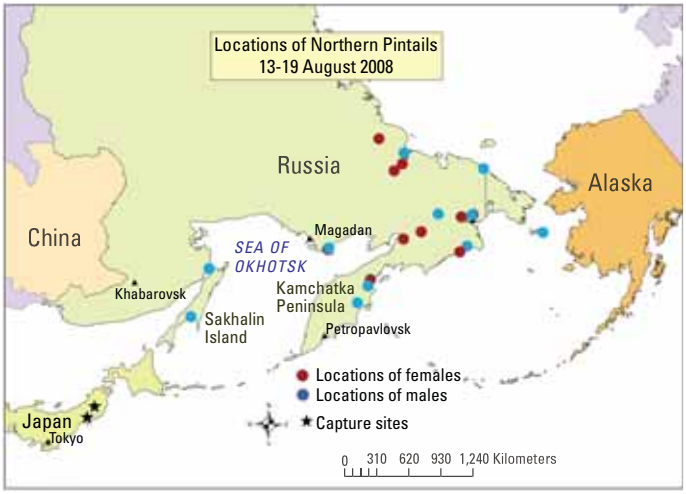
By Catherine Puckett

Wild migratory birds may be more important carriers of avian influenza viruses from continent to continent than previously thought, according to new scientific research that has important implications for highly pathogenic avian influenza virus surveillance in North America.

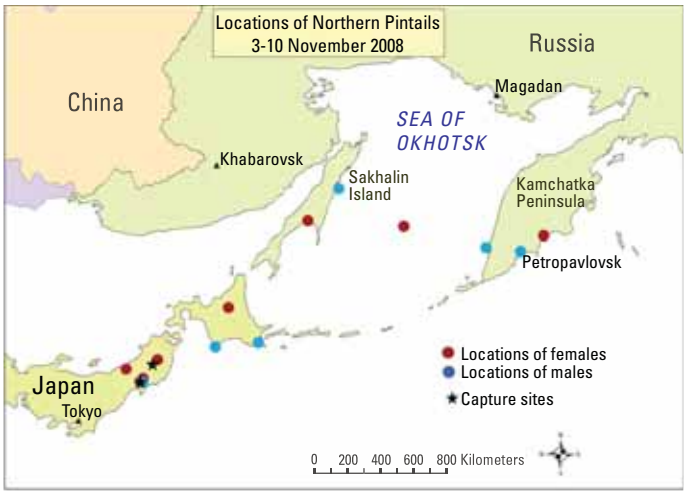
As part of a multipronged research effort to understand the role of migratory birds in the transfer of avian influenza viruses between Asia and North America, scientists with the U.S. Geological Survey (USGS), in collaboration with the U.S. Fish and Wildlife Service in Alaska and the University of Tokyo, have found genetic evidence for the movement of Asian forms of avian influenza to Alaska by northern pintail ducks, which spend time both inland and in coastal areas.

In an article published online in October 2008 in the journal *Molecular Ecology*, USGS scientists observed that nearly half of the low-pathogenic avian influenza viruses found in wild northern pintail ducks in Alaska contained at least one (of eight) gene segments that were more closely related to Asian than to North American strains of avian influenza.

Over the past decade, a highly pathogenic form of the H5N1 avian influenza virus spread across Asia to Europe and Africa, causing the deaths of 245 people and raising concerns of a possible human pandemic. The role of migratory birds in moving the highly pathogenic virus to other geographic areas has been a subject of debate among scientists. Disagreement has focused on how likely it is for H5N1 to disperse among continents via wild birds.



Northern pintails marked with satellite transmitters in February 2008 were distributed as shown in mid-August, when they were nesting and molting in Russia and on St. Lawrence Island, Alaska. One goal of the research project is to estimate the extent to which Asian and North American pintails use the same nesting and molting areas, where they might exchange influenza viruses.



Locations during early November of northern pintails marked with satellite transmitters in February 2008. Red dot in the middle of the Sea of Okhotsk shows the position of a female during her southwestward flight from the nesting area to wintering sites in the Japanese Archipelago. Visit URL ***http://alaska.usgs.gov/science/biology/avian_influenza/pintail_movements.html*** *for additional information.*

"Although some previous research has led to speculation that intercontinental transfer of avian influenza viruses from Asia to North America via wild birds is rare, this study challenges that," said **Chris Franson**, a research wildlife biologist with the USGS National Wildlife Health Center and coauthor of the study. **Franson** added that most of the previous

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A male northern pintail duck in Japan. Photograph courtesy of USGS.

► ***Dr. Hiroyoshi Higuchi*** *(left),* ***Mr. Kenichi Tokita*** *(right), and other cooperators from the University of Tokyo work with USGS scientists to attach satellite transmitters to the backs of northern pintails on wintering areas of northern Honshu, Japan. Transmitters are used to evaluate the ducks' movements, migration, and areas of overlap with North American northern pintails. Photograph courtesy of USGS.*

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studies examined bird species that are not transcontinental migrants or were from mid-latitude locales in North America, far removed from sources of Asian strains of avian influenza.

Scientists with the USGS, in collaboration with the U.S. Fish and Wildlife Service, State agencies, and Alaska Native communities, obtained samples from more than 1,400 northern pintails at sites throughout Alaska. Samples containing viruses were then analyzed and compared with virus samples from other birds in North America and eastern Asia, where northern pintails are known to winter. Researchers chose northern pintails as the focus of the study because they are fairly common in North America and Asia, they are commonly infected by low-pathogenic avian influenza, and they are known to migrate between North America and Asia. None of the samples were found to contain completely Asian-origin viruses, and none were highly pathogenic.

"This kind of genetic analysis—using the low-pathogenic strains of avian influenza virus commonly found in wild birds—can answer questions not only about the migratory movements of wild birds, but also about the degree of virus exchange that takes place between continents, provided the right species and geographic locations are sampled," said **John Pearce**, a research wildlife biologist with the USGS Alaska Science Center and coauthor of the study. "Furthermore, this research validates our current surveillance sampling process for highly pathogenic avian influenza in Alaska and demonstrates that genetic analysis can be used as an effective tool to further refine surveillance plans across North America," **Pearce** added.

Implications of this research include:

- Migratory bird species, including many waterfowl and shorebirds, that commonly carry low-pathogenic avian influenza and migrate between continents may carry Asian strains of the virus along their migratory pathways to North America.
- USGS researchers found that nearly half of influenza viruses isolated from northern pintail ducks in Alaska contained at least one of eight virus genes that were more closely related to Asian than North American strains. None of the samples contained completely Asian-origin viruses, and none were highly pathogenic forms that have caused deaths of domestic poultry and humans.
- The central location of Alaska in relation to Asian and North American migratory flyways may explain the higher frequency of Asian lineages observed in this study relative to more southerly locations in North America. Thus, continued surveillance for highly pathogenic viruses by sampling of wild birds in Alaska is warranted.

A flock of wintering northern pintails in northern Honshu, Japan. Photograph courtesy of USGS.

Adding the type of genetic analyses used in this study to future surveillance for avian influenza in wild birds will lead to better understanding of patterns of migratory connectivity between Asia and North America and virus ecology.

For more information about USGS research on avian influenza and northern pintails, visit URL **http://alaska.usgs.gov/science/biology/avian_influenza/pintail_movements.html**.

The full reference for the new paper is:

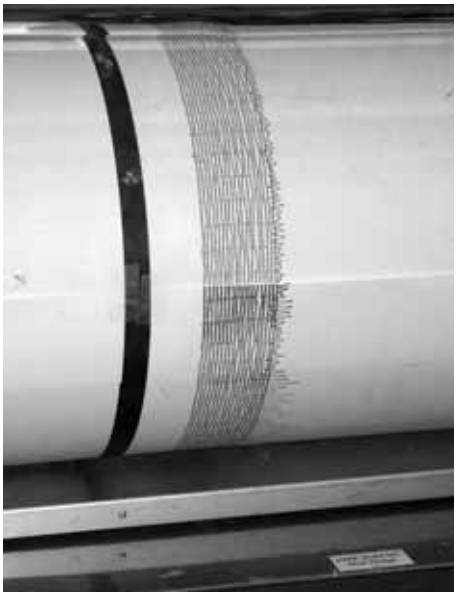
Koehler, Anson V., Pearce, John M., Flint, Paul L., Franson, J. Christian, and Ip, Hon S., 2008, Genetic evidence of intercontinental movement of avian influenza in a migratory bird; the northern pintail (*Anas acuta*): Molecular Ecology, v. 17, no. 21, p. 4754-4762, doi:10.1111/j.1365-294X.2008.03953.x [URL **http://dx.doi.org/10.1111/j.1365-294X.2008.03953.x**].

A resident of Iwate Prefecture feeds a wintering flock of northern pintail ducks and whooper swans in northern Honshu, Japan. In spring 2008, both of these species were observed on wetlands in Japan where the highly pathogenic H5N1 strain of avian influenza was detected, and several swans died from exposure to the virus. Photograph courtesy of USGS.

Earth Science Day 2008 Delights Visitors to the USGS in Menlo Park, California

By Helen Gibbons

A teacher and her students were viewing an old seismograph set up for display at the U.S. Geological Survey (USGS) office in Menlo Park, California, when suddenly the instrument's pen began to swing wildly. The teacher turned to a nearby USGS employee, **Susan Garcia** of the Earthquake Hazards Team, and asked, "Is this an earthquake?" It was! The earthquake waves, too weak to be felt by humans, had just arrived at a sensor in northern California, and the signals transmitted to Menlo Park were being traced on the paper roll of the display seismometer. Such mechanical recorders have largely been replaced by networked computers that begin processing earthquake signals as soon as they arrive. Rushing to a desktop computer, **Garcia** viewed the USGS Earthquake Hazards Program Web site (URL **http://earthquake.usgs.gov/**), where preliminary information had already been posted: a magnitude 6.6 earthquake had struck off the coast of Mexico near the town of Chiapas at approximately 12:41 p.m. Pacific Daylight Time (visit URL **http://earthquake.usgs.gov/eqcenter/recenteqsww/Quakes/us2008yfbk.php** for details). The teacher and her students were thrilled. This was just one of many exciting moments during Earth Science Day, held Thursday, October 16, for school groups visiting the Menlo Park campus.



Record of a magnitude 6.6 earthquake offshore Chiapas, Mexico—transmitted from a sensor in northern California—is rolling underneath drum in display seismograph on the USGS campus in Menlo Park, California. A visiting teacher and her students were viewing the seismograph when the earthquake signals began to be recorded.

***Mary McGann** (left) lines up the shells of some one-celled organisms for a student to view through the microscope. Photograph by **Paul Laustsen**.*

Most of the other learning experiences were less spontaneous but no less engaging. More than 30 displays around campus offered hands-on activities to approximately 1,000 children in grades 2 through 6. Many of the displays had coastal or marine themes: virtual flights over the sea floor in San Francisco Bay created by computer manipulation of bathymetric data (**Pete Dartnell** and **Jamie Conrad**), tiny shells of one-celled marine organisms viewed through microscopes (**Mary McGann**), clear plastic trays marked with contour lines that students stacked to reveal three-dimensional models of an island and a submarine canyon (**Florence Wong**, **Mike Torresan**, and **Ray Sliter**), an imaginary dive in the submersible *Alvin* to view mineral deposits and exotic animals at hot springs along a midocean spreading ridge (**Carol Reiss** and **Randy Koski**), a conductivity meter that students used to determine the sources of various water samples (**Jim Kuwabara** and **Brent Topping**), and several displays on tsunamis: video footage of the December 2004 Indian Ocean tsunami (**Walter Mooney**, **Shane Detweiler**, **Kurt Loeffler**, **Justine Gesell**, and others), a model showing how sudden movement of the sea floor by earthquakes triggers tsunamis (**Walter Mooney**, **Shane Detweiler**, **Jillian McLaughlin**, and others), and a model where students learned about landslide-generated tsunamis by sliding a brick (the "landslide") into a tub of water to trigger a set of waves (the "tsunami") (**Eric Geist** and **Homa Lee**).

The ground around the landslide-generated-tsunami display quickly became soaking wet, as did the children whose particularly large tsunamis splashed out of the tub. Warm weather and plenty of towels helped the visitors dry off quickly so that they could enjoy the rest of the exhibits, which included hands-on rock and mineral displays, a challenging plate-tectonic puzzle, a group simulation of "human seismic waves" that taught children how compressional and shear waves transmit earthquake energy, live insects in

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***Florence Wong** (center) watches as a student assembles a "Topo Salad Tray" model of the topography of Angel Island (an island in San Francisco Bay). Photograph by **Paul Laustsen**.*

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***Eric Geist** (left) demonstrates how marine landslides create tsunamis to a student eager to take his turn. Photograph by **Paul Laustsen**.*

***Molly Ward**, Slow the Flow Program Coordinator at the Don Edwards San Francisco Bay National Wildlife Refuge, teaches visiting students about the importance of balance between freshwater and saltwater (each represented by one hand) in San Francisco Bay wetlands. Photograph by **Helen Gibbons**.*

a display about the environmental effects of mining activities, a demonstration of how volcanic calderas form, striking images of the eruption of Hawaii's Kilauea Volcano, a model showing how water erodes landscapes, and a scientist-powered "earthquake ride."

Several outside organizations enriched the day by bringing displays to campus. Employees from the Coyote Point Museum (URL **http://www.coyoteptmuseum.org/**) used a live owl, student-constructed paper helicopters, feathers, foam, and a vertical wind tube to get children thinking about what makes something fly, flutter, or float. Exhibitors from the California Academy of Sciences (URL **http://www.calacademy.org/**) used the skulls of various mammals to help children think about how teeth function and what fossil teeth can tell you about their previous owners. Environmental educators from Don Edwards San Francisco Bay National Wildlife Refuge (URL **http://www.fws.gov/desfbay/**) used a watershed model to help children understand how water moves through our watershed and affects the health of plants and animals in San Francisco Bay.

The visitors were quite pleased with the day's offerings, as reflected in written feedback from numerous teachers. Here are a few samples:

- "…It was a great success for our kids; they came back enthused and stimulated to learn more…"
- "This was an awesome day. My students and I truly enjoyed ourselves and learned so much…"
- "…Our experience was amazing. The amount of time that was spent to create an exciting and educational experience was beyond belief…[we] were so impressed with the level of detail that went into all the stations."

Earth Science Day was part of the nationwide celebration of Earth Science Week, held this year from October 12 to 18, 2008, with the theme "No Child Left Inside." For more information about Earth Science Week, visit URL **http://www.earthsciweek.org/**. For more information about Earth Science Day 2008 at the USGS in Menlo Park, visit URL **http://volcanoes.usgs.gov/about/edu/esd/**.

***Dina Venezky** gives visiting students some tips on assembling plate-tectonic puzzles. Photograph by **Paul Laustsen**.*

***Helena Carmena** of the California Academy of Sciences talks to students about teeth and what they can tell you about their owners. Photograph by **Leslie Gordon**.*

Gene Shinn Wins Preeminent SEPM Twenhofel Medal

By Barbara Lidz

Eugene A. Shinn, carbonate geologist with Shell Oil in the 1960s and then with the U.S. Geological Survey (USGS) for 31 years, will receive the 2009 William H. Twenhofel Medal from the Society for Sedimentary Geology (SEPM). The highest recognition given by the SEPM, the Twenhofel Medal is awarded annually to a person for his or her outstanding contributions in sedimentary geology. **Albert C. Hine**, Associate Dean of Research at the University of South Florida (USF) College of Marine Science in St. Petersburg, made the announcement in August. **Shinn** received an honorary Ph.D. from USF in 1998 and was a commencement speaker. Since retiring in 2006 from the USGS Florida Integrated Science Center office in St. Petersburg, **Shinn** has been seated as a Courtesy Professor at the USF College of Marine Science next door.

Nominees for the Twenhofel Medal are chosen for their outstanding contributions in paleontology, sedimentology, stratigraphy, and (or) allied scientific disciplines. The contributions normally entail extensive personal research but may involve some combination of research, teaching, administration, or other activities that have notably advanced scientific knowledge in the field of sedimentary geology. **Shinn** has devoted his career to each of these areas and more, and has excelled in all. As a researcher dedicated to working in the field, he is recognized as a pioneer in studies of carbonate sediment, tidal flats, diagenesis, coral-reef ecosystems, and, in recent years, the effects of transatlantic African dust on corals and human health. **Shinn** has an innate ability often to perceive truths before others do, and he encourages discussion and innovative thinking. He is not afraid to speak his mind or to get on the hot seat amidst controversy; he also knows when to avoid controversy. **Shinn** has led numerous modern-carbonate field trips to the Florida Keys and the Bahamas for SEPM, the American Association of Petroleum Geologists (AAPG), the Geological Society of America (GSA), and many universities and local societies. He has published more than 150 scientific papers, produced training films, won several "best paper" awards, and received the USGS Meritorious Service Award, as well as the USGS Gene Shoemaker Award for Excellence in Communications. **Shinn** joins the ranks of other very distinguished geologists who have shaped major concepts in understanding Earth processes and history in the realm of carbonate geology. The honor is long overdue. **Shinn** will receive the award at the Society's annual meeting in Denver in June 2009. Congratulations, **Gene**, for a meritorious job well done!

William H. Twenhofel (1875-1957), Ph.D. Yale (1912), is regarded as the patriarch of sedimentary geology. **Twenhofel**, who was a member of the National Research Council, retired in 1945 from an illustrious academic career at the University of Wisconsin, Madison, where the Department of Geology and Geophysics has offered one of the top Earth-science programs in the United States for decades. **Twenhofel** cofounded the *Journal of Sedimentary Petrology*, now the *Journal of Sedimentary Research*, one of the premier journals in the field of sedimentary geology.

◄ ***Gene Shinn*** *(left) and* ***Terry Edgar*** *(USGS, retired) collect a sediment core in a dry karst pond at Terra Ceia Aquatic Preserve, lower Tampa Bay, Florida, to test water-table depth and ground-water salinity. One of three formerly isolated, low-salinity or freshwater ponds in a preserve that was ditched in the 1950s and 1960s when the surrounding uplands were under agricultural production, this pond currently is poorly connected to tidal flow by manmade ditches. In wet years, the pond retains brackish water year round; in dry years, like that shown, salinities increase to hypersaline (greater than 40 psu), water levels fall, fish die, and the ponds go dry. As part of a restoration project by the Southwest Florida Water Management District, the ditches to this and the two other ponds will be plugged in an effort to return the ponds to permanently inundated, low-salinity conditions, which will provide a greater diversity of fish and wildlife habitats. How long it will take for natural processes to leach accumulated salts from the sediment underlying the ponds is unknown.*

USGS Collaborator Wins Prestigious SEPM Shepard Medal

By Barbara Lidz

Albert C. Hine, a close collaborator with scientists at the U.S. Geological Survey (USGS) office in St. Petersburg, Florida, from its inception in 1988, will receive the Francis P. Shepard Medal for Marine Geology at the 2009 Society for Sedimentary Geology (SEPM) annual meeting in Denver. **Hine** is currently Associate Dean in the College of Marine Science at the University of South Florida (USF) in St. Petersburg, where he began his career in 1979. He has worked extensively with USGS personnel for many years, including **Gene Shinn** (who will receive SEPM's Twenhofel Medal at the 2009 meeting; see article, this issue), **Bob Halley**, **Barbara Lidz**, **David Twichell**, **Kevin Cunningham**, **Jack Kindinger**, **Lisa Robbins**, **Terry Edgar**, and **Kim Yates**.

Hine received his B.S. degree from Dartmouth, his M.S. from the University of Massachusetts, Amherst, and his Ph.D. from the University of South Carolina. For his dissertation he investigated modern carbonate-bank-margin sediment on the Bahama Banks with high-resolution seismic profiling. He studies coastlines, continental shelves, carbonate platforms, and coral reefs, using an array of geophysical tools. **Hine**

Al Hine *aboard the University of South Florida research vessel* Suncoaster.

has been heavily involved in the Ocean Drilling Program (ODP) and served on the program's Ocean History Panel, Site Survey Panel, and U.S. Science Advisory Committee; he was also selected to be a Joint Oceanographic Institutions/ U.S. Science Advisory Committee Distinguished Lecturer for 2005-2006 (URL **http://www.oceanleadership.org/usssp/dls/hine**). **Hine** has had extensive seagoing experience on many research vessels, including as co-Chief Scientist on ODP Leg 182 to the Great Australian Bight and as a member of the scientific crew on Leg 194 to the Marion Plateau of northeastern Australia. He currently serves on the University-National Oceanographic Laboratory System (UNOLS) Fleet Improvement Committee.

Hine has written approximately 140 peer-reviewed journal articles and book chapters. He is major advisor to 11 Ph.D. and 22 M.S. candidates, including 2 from the USGS. His former graduate students are spread far, wide, and deep. In recent years, he has focused on deep-water coral reefs and drowned barrier islands; with **Bob Halley** and others, he mapped the deepest coral reef in the United States, off the southwest coast of Florida (see related *Sound Waves* articles at URLs **http://soundwaves.usgs.gov/2003/07/** and **http://soundwaves.usgs.gov/2005/02/research2.html**).

The Shepard Medal is given to persons who have a sustained record of outstanding research contributions in marine geology. **Francis Parker Shepard** (1897-1985), known as "The Father of Marine Geology," is one of the field's true heroes. **Shepard** began his career studying structural geology but is best known for his work on, and understanding of, submarine canyons. A short story of his life is available as a PDF file (76.4 KB) at URL **http://gsahist.org/gsat/gt01dec20_21.pdf**.

New Chief Scientist for the Western Coastal and Marine Geology Team

By Mike Shulters

Michael D. Carr has become the new Chief Scientist for the U.S. Geological Survey (USGS)'s Western Coastal and Marine Geology Team. He succeeds **Sam Johnson**, who will continue with the team as a research scientist. **Carr's** selection was announced on November 7, 2008, by Acting Southwest Area Regional Executive **Mike Shulters**.

Carr joined the USGS in 1979 as a National Research Council Postdoctoral Research Associate. He was an undergraduate at Franklin and Marshall College and received both his M.A. and Ph.D. degrees in geology from Rice University. **Carr** became a permanent member of the USGS in 1981, joining the Yucca Mountain Project. Over the following decade, he became part of the scientific leadership and management team for this multidisciplinary project, which included studies of neotectonics, Quaternary stratigraphy, erosional processes, paleoclimate, volcanic stratigraphy, soils, Cenozoic tectonics and volcanism, Paleozoic stratigraphy, hydrogeologic framework, and crustal structure—all aimed at evaluating the suitability of the proposed site for disposal of high-level nuclear waste in southern Nevada. He also participated in projects of the National Geologic Mapping Program, mapping in the southern Great Basin and the Mojave Desert. From 1993 to 1996, **Carr** served as the USGS Global Change Research Program Coordi-

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nator in the Office of the Director. During his tour in the Director's Office, he also acted as program coordinator during the early development of the USGS Ecosystem Program. **Carr** previously served as the Team Chief Scientist of the USGS Western Coastal and Marine Geology Team from 1996 through 2001. He acted as Western Regional Geologist from 2002 to 2003 and was the Associate Western Regional Geologist from 2003 to 2007. Since October 2007, he has been the Regional Science Coordinator for Geology and concurrently acted as Chief Scientist for the Earthquake Hazards Team from May through September of 2008.

***Michael D. Carr** at the USGS Pacific Science Center, Santa Cruz, California.*

Carr's extensive experience in many levels of the organization and his commitment toward broadening the scope and reach of USGS science will enable him to be an outstanding leader for the Western Coastal and Marine Geology Team. As **Sam Johnson** returns to science, please join us in thanking him for positioning the team and the region to play an even stronger role in coastal and ocean science. Welcome **Mike** back to the Team Chief Scientist position, which he assumed on November 23, 2008.❁

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