USGS

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Fieldwork

Survey of Offshore Hazards in Southern California

By Michael A. Fisher, Christina E. Gutmacher, and Helen Gibbons

On June 14, the contract vessel *Auriga* left the USGS' Marine Facility in Redwood City, CA, bound for Southern California. Its mission was to conduct a two-week survey of offshore geologic hazards in the Santa Barbara Channel, a large east-west waterway between the coastal city of Santa Barbara on the north and several of the Channel Islands on the south. This waterway is prized equally, but with continued controversy, for its wildlife and Mediterranean climate and for its rich offshore oil reserves. Over a long time scale, the area's tranquillity has been disrupted by offshore earthquakes and submarine landslides, both of which can trigger tsunamis. Each of these issues was addressed by the recent cruise, whose main goals were to

- collect seismic-reflection data to investigate offshore geological hazards, such as earthquakes, landslides, and tsunamis
- conduct subsidiary research funded by the Department of Interior's Minerals Management Service (MMS), which is keenly interested in locating natural submarine seeps of tar and heavy oil in its efforts to determine whether oil on the shoreline comes from spills or seeps

The USGS scientists conducting this survey benefited from early, close consultation with cooperating scientists at the University of California, Santa Barbara, and at Moss Landing Marine Laboratories. Data collected during the survey will be interpreted in collaboration with academic colleagues to support several National Science Foundation proposals.

The *Auriga* and its crew enjoyed splendid weather during the early-morning departure past the glittering cityscape of downtown San Francisco, then ran headlong into full-gale conditions in southern California. On the way south, the 150-ft-long ship was

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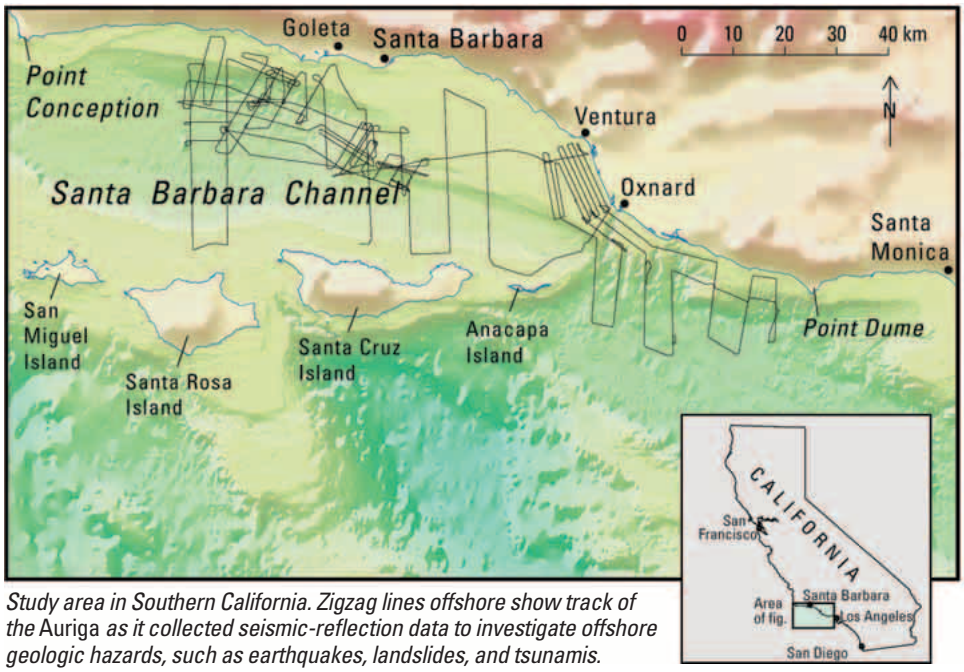
Larry Kooker *(left) and cruise chief scientist* ***Mike Fisher*** *monitor seismic-reflection data on the* Auriga.



Study area in Southern California. Zigzag lines offshore show track of the Auriga *as it collected seismic-reflection data to investigate offshore geologic hazards, such as earthquakes, landslides, and tsunamis.*

Sound Waves

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Fieldwork, continued

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crowded with crew and equipment. The tools of the marine geologist's trade jammed the rear deck: four bright-yellow "fish" housed the sidescan-sonar, the Huntec, the chirp profiler, and the 12-kHz bathymetric-profiler systems. Also on deck were the multichannel seismic streamer, the air compressor, and various winches. Much of the deck space was occupied by four large shipping containers, which housed facilities for data recording and archiving, and tools and repair space for all USGS equipment.

The vessel was staffed by six members of the ship's crew, six USGS geologists, three technicians from the USGS' Marine Facility in Redwood City, CA, one technician under contract, and five biologists from Cascadia Research, a nonprofit research organization based in Olympia, WA. These 21 people shared 14 first names, as well as tight quarters. "Mike" was the go-to guy, as there were five of them.

The first part of the survey involved 4 days of collecting sidescan-sonar data near Point Conception for the MMS. Sidescan-sonar data provide a photograph-like view of the sea-floor surface. These data will help the MMS update its map of natural oil and gas seeps in this area. The main issue is that long stretches of beach are befouled by tarballs, and iridescent oil sheens are evident offshore, much to the dismay of the local populace. Scientists and managers in MMS are working with USGS scientists to assess the extent of natural sea-floor seepage of tar and heavy oils. USGS geochemists are also "fingerprinting" the natural oils, which will help MMS distinguish them from produced oils spilled during human activities. Previous surveys showed numerous sea-floor pockmarks and both acoustic and methane anomalies in the water column. Fortunately, this work in the typically windiest area was completed before the gales struck.

Ray Sliter *(left) and* ***Mike Boyle*** *maneuver the 12-kHz fish back into its cradle after two weeks' steady duty.*

The main and later part of the survey focused on collection of seismic-reflection data to support studies of geologic hazards, such as earthquakes, landslides, and tsunamis. Seismic-reflection data reveal information about sediment layers and bedrock features below the sea floor. Such data were collected to image some of the more ominous offshore features, such as the Oak Ridge thrust fault and its along-strike extension, the Mid-Channel thrust fault, which might be capable of generating damaging earthquakes. The scientists surveyed the area where the Oak Ridge fault intersects the coast, to fill gaps between maps of onshore and offshore fault segments. Also, they surveyed numerous fault strands that offset rocks very close to shore near the city of Santa Barbara. This survey of possible earthquake faults sets the stage for important future research goals, which include obtaining rock and sediment samples from opposite sides of some of the main faults to determine deformation rates and earthquake-recurrence intervals.

The scientists also investigated the Goleta submarine landslide, which is famous among marine researchers, in part because of its clear expression in bathymetric maps created from multibeam-sonar data. To foster research into the mechanics of slide generation and emplacement, the USGS scientists obtained both high-resolution and airgun seismic-reflection data over this feature. The high-resolution data provide a detailed look at sediment layers as much as 75 m below

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*A common dolphin (*Delphinus *sp.) swims near the* Auriga. *It was one of hundreds of dolphins surrounding the ship, all moving so swiftly in and out of the water that this is the sole photo!*

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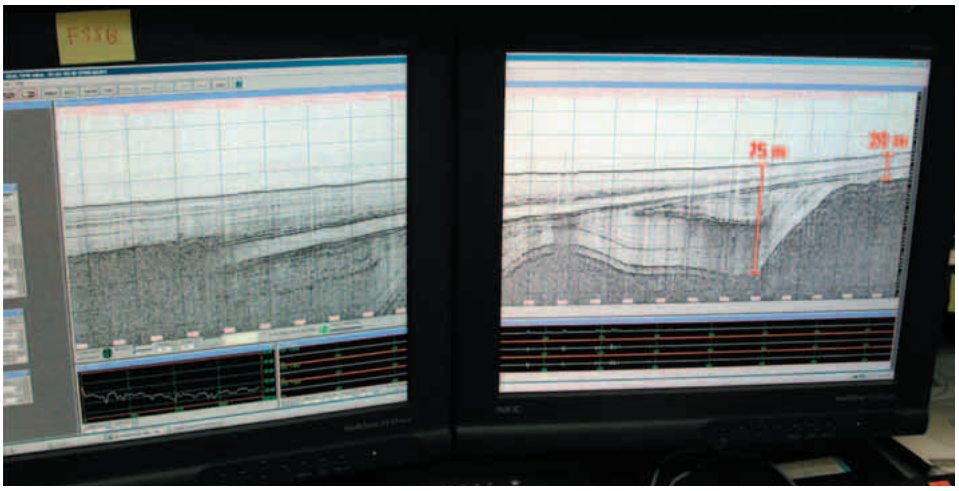
the sea floor. The airgun data provide less detail but give scientists a look at features as much as 1 km below the sea floor.

Surveying had to be suspended whenever marine mammals got too close to the vessel, which occurred several times each day and occasionally lasted for more than half an hour. Starting in the mid-1990s, marine researchers planning to use sound energy to probe beneath the sea floor were required to obtain permits specifying the conditions under which they could operate seismic sound sources, such as airguns. The permit requirement was established to protect marine mammals that use sound themselves for various purposes, including communication, navigation, and locating prey. Once a bureaucratic quagmire, acquiring permits to conduct seismic surveys near marine mammals has become routine. A new twist is that endangered marine turtles have been added to the list of protected species. For last June's *Auriga* cruise, the USGS scientists obtained permits from the California Coastal Commission, the California State Lands Commission, and the National Marine Fisheries Service. The Channel Islands National Marine Sanctuary also advised them.

The biologists aboard the *Auriga* identified and observed the behavior of marine mammals, such as blue and humpback whales; common, Pacific white-sided, and Risso's dolphins; and California sea lions, harbor seals, and sea otters. Surveying operations were suspended while the animals were in the designated safety zones, which differed by species and sound source, as specified in the permit. One night, operations were suspended for 3 hours while dolphins followed the *Auriga* despite the crew's efforts to evade them.



Dual monitors display seismic-reflection data from the chirp subbottom profiler. The image displayed across the two monitors represents data collected along a seismic line about 2 km long. Approximate thickness of the sedimentary deposits (resting on bedrock) is labeled in two spots on the right-hand screen. An unconformity within the sedimentary deposits is clearly evident on the same screen.

Other cooperative work was conducted with Cascadia Research biologists who are investigating the effects of airgun signals on large whales. Their ship, the research vessel *Robert Gordon Sproul* from the Scripps Institution of Oceanography, and the *Auriga* converged at Santa Rosa Island, where, by chance, 20 to 30 large whales loitered. Biologists on both ships and in an inflatable boat observed whale behavior as the *Auriga* fired its airgun along several tracklines. Initial reports from the biologists are that the whales first made room as the *Auriga* approached them and then returned to the original area once the vessel departed. Apparently, the airgun caused neither hurried dispersal nor long-term interruption of whale activities. Eventually, such investigations will provide answers to outstanding controversies about whether sound sources used for marine research actually harm ocean animals.

Commonly, seismic data are collected with the ship headed parallel to the troughs of offshore waves. This direction is good for data but stressful for people. To atone for long seasick hours, we celebrated the end of the cruise with a swim call. Many participants, faces in frozen shock, spent as much as 30 seconds in the 52˚F water.❁

U.S. and Canadian Scientists Map Georges Bank Geology and Habitats

By Page Valentine

Page Valentine (USGS, Woods Hole, MA) and **Steve Fromm** (National Marine Fisheries Service, Sandy Hook, NJ) participated in a cruise of the Canadian research vessel CCGS *Hudson* in June 2002 to Georges Bank in the Gulf of Maine, off the coast of Nova Scotia. They are collaborating with Geological Survey of Canada (GSC) colleagues **Brian Todd** and **Vladimir Kostylev,** who have similar research interests. They are mapping the seabed geology and biological habitats of areas that have been imaged during recent multibeam surveys carried out by the GSC.

The cruise was spent ground-truthing the multibeam survey of the Canadian part of Georges Bank, where the seabed is similar in most respects to the unmapped U.S. part. Ground-truthing methods included video and photo transects and bottom sampling, methods also employed by the USGS and the National Marine Fisheries Service in their work in the Gulf of Maine. Geophysical surveys (sidescan sonar and subbottom profiling) were conducted in selected areas to aid in the interpretation of glacial features observed in the multibeam images. In addition, **Valentine**, **Todd**, and **Kostylev** are collaborating in the development of a habitat-classification system for the Gulf of Maine. This cruise was the first opportunity to test it in the field.❁

Studies of Contaminated Ground Water Yield New Insights into Degradation of Diesel Fuel

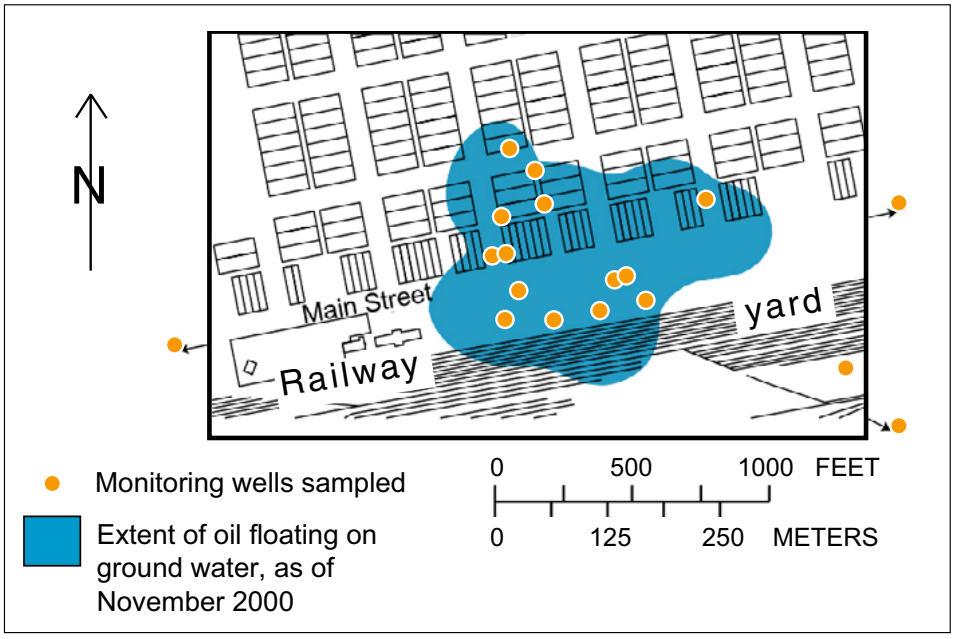
By Fran Hostettler and Keith Kvenvolden

Over time, oil spilled into the ground can degrade into a mixture of hydrocarbons so complex that it can mislead scientists trying to identify the origin of the spill. This new insight was among the findings presented by USGS scientist **Fran Hostettler** at the Arctic Marine Oilspill Program (AMOP) meeting held in June in Calgary, Alberta, Canada. These findings, which will assist future investigations of onland oil spills, grew out of USGS studies of contaminated ground water in Mandan, ND.

In 1999, the North Dakota Department of Health (NDDH) was facing a big problem—a very large pool (estimated at 1.5–3 million gal) of oil was floating on top of the ground water beneath the downtown area in Mandan, ND. The brand new building housing the sheriff's office, for example, became uninhabitable on its lower floor owing to odor and health problems caused by the chemicals after a rainy season raised the water table. The downtown contains only an 8- to 10-square-block business area, but a large railroad facility is adjacent to it and the rest of the town (see map). Spills of diesel fuel in the railroad yard have been common for about 50 years. The railroad acknowledged responsibility for spillage within the railroad yard, but it was unclear whether the railroad was responsible for the contamination under the downtown. Early assessments of the ground-water hydrology and chemical analyses contracted by the railroad led the company to doubt that the contamination under the downtown was all spilled diesel fuel.

In 2000, the USGS, as an independent and unbiased external agency, was asked by the NDDH to do a complete characterization of the contamination and the hydrologic setting. USGS scientists taking part in this study were geochemists **Keith Kvenvolden** (Menlo Park, CA) and **Jon Kolak** (Reston, VA), chemists **Fran Hostettler** (Menlo Park, CA) and **Colleen Rostad** (Denver, CO), and hydrologists **Geoff Delin** (Mounds View, MN) and **Larry Putnam** (Rapid City, SD).

Engine at railroad facility in Mandan, ND.



Map showing downtown Mandan, ND, and extent of contaminated ground water (blue area) as of November 2000. Orange dots are monitoring wells.

The hydrologists showed that the ground-water flow, previously assumed to be to the southeast and away from the downtown and the contaminated ground water, could vary seasonally. Recharge from precipitation seeping into the ground could change and reverse the flow direction back toward the downtown. Thus, the hydrogeologic part of the study suggested a reasonable explanation for the position of the oil under downtown Mandan.

The geochemical analysis was highly complex, owing to the length of time (10–50 years) the oil had been in the ground and the extent of degradation of the hydrocarbons over that time. The floating oil was a complex hydrocarbon soup! After analyzing all the chemical constituents, however, the USGS scientists concluded that all the downtown oil is diesel fuel from a single source (railroad diesel produced at a local refinery), at diverse stages of biodegradation. No evidence was found of any industrial solvents or chemicals, or other hydrocarbon fuels, except for traces of gasoline at one outlying site.

As the USGS scientists continued to examine their results, they found even more compelling evidence in support of their conclusions. Comparison of the degradation patterns of the hydrocarbons with those from a well-studied 1979 oil spill in Bemidji, MN, showed that the patterns were the same. Furthermore, these degradation patterns were unusual, and some of them were previously unrecognized in the scientific literature. Most oil spills are degraded by weathering and air oxidation; however, both the Mandan and Bemidji spills had been in the ground

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for so long that their environment had become anoxic. An anoxic environment changes the nature of the microorganisms that degrade oils, as well as the pattern of chemical degradation. The little bugs slowly eat away at the molecules, not starting with the small molecules, as is the case in air oxidation, but starting at the ends of the larger molecules, especially the paraffins and the alkylcyclohexanes. This pattern of degradation at Mandan resulted in residual oil that produced a chemical fingerprint that looked surprisingly like a mixture of slightly lower-range refinery fuels. In other words, the new degradation pattern that the USGS scientists were documenting mimics what could be interpreted as a mixture of other fuels, and so care must be taken in the interpretation.

This discovery, in addition to allowing the USGS group to sort out the chemical soup at Mandan, is of interest to the scientific community because it is one of the first documented environmental occurrences of anoxic biodegradation of specific types of hydrocarbons that are the main components of fuels. It also will be significant in future forensic evaluations of fuel spills.

In 2001, the USGS scientists were honored by the USGS' North Dakota District Office for their teamwork and for the timeliness and high quality of their report, entitled "Hydrologic Setting and Geochemical Characterization of Free-Phase Hydrocarbons in the Alluvial Aquifer at Mandan, North Dakota, November 2000" (see article in November 2001 *Sound Waves*). The paper that **Fran** presented at June's AMOP meeting, entitled "Alkylcyclohexanes in Environmental Geochemistry" and coauthored by **Keith Kvenvolden**, was an outgrowth of that award-winning research.

Parasites as Indicators of Coastal-Ecosystem Health

By Gloria Maender

When USGS scientist **Kevin Lafferty** visits a salt marsh at low tide, he sees much more than algae-green-tinted mudflats, tidal sloughs, and brine-adapted pickleweed. Like other visitors, he sees the bustle of life around the mudflats—from clams, snails, and crabs to shorebirds and long-legged waders, and gobies and killifish in the shallows of the estuary. Unlike most visitors, however, **Lafferty** focuses his thoughts on the parasites that are an integral, though often unnoticed, part of a healthy salt marsh.

According to **Lafferty** and his research colleagues, parasitic trematodes—a type of worm—are like puppeteers directing the lives of the animals that use the salt-marsh environment. The parasites' lifestyle is one of "body snatching" and mind control of their hosts, the envy of science-fiction horror movies. Apart from having fascinating science-fiction life cycles, however, these parasites serve as barometers of the well-being of a salt marsh.

"Paradoxically, healthier, less degraded ecosystems tend to have more parasites with complex life cycles than do altered systems, because these parasites depend on functioning natural systems," said **Lafferty**, a marine biologist at the USGS' Western Ecological Research Center Field Station in Santa Barbara, CA.

Most trematodes, said **Lafferty**, must infect three different host animals—first, intermediate, and final—to develop into egg-producing adults. If one of the host animals is missing, as it may be in a degraded ecosystem, the parasite cannot complete its life cycle.

*This free-swimming stage of a parasite larva, a trematode cercaria, leaves an infected snail to encyst on a fish brain. View is 0.267 mm across. Courtesy of **Todd Huspeni**, University of California, Santa Barbara.*

"Changes to parasite communities can profoundly alter natural systems," said **Lafferty**. Changes most likely to affect parasite communities are alterations in the communities of the parasite hosts, the animals that the parasite uses to complete its life cycles. Today, these changes are most likely to occur because of climate change and environmental degradation, including habitat fragmentation, pollution, overharvesting of marine species, and introduced nonnative species.

In 2001, **Lafferty** and colleagues at the University of California, Santa Barbara (UCSB), began research funded by the U.S. Environmental Protection Agency to develop tools using parasites to monitor the health

*Horn snails, like these in a salt marsh in Morro Bay, CA, are hosts to 17 different kinds of trematode worms. Photo by **Kevin D. Lafferty**, USGS.*

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of salt marshes. New funding from the National Science Foundation and the National Institutes of Health will support student research during the next 5 years, under the direction of three principal investigators, **Lafferty**, **Armand Kuris** (professor of zoology at UCSB), and **Andrew P. Dobson** (professor of zoology at Princeton University). They are examining 17 different kinds of trematodes found in horn snails, an abundant snail in salt marshes in California and Mexico and on the Gulf Coast.

"A measure of the trematode community, gathered from dissecting snails that act as the first host of these worms, provides a single, integrated snapshot of host species that have been in an estuary over the average lifespan of the snails that occur there," said **Lafferty**. Intact trematode communities are assurances of the healthy integrity and diversity of species within the salt marsh.

Trematode infection begins as a horn snail grazing on algae incidentally ingests worm eggs, perhaps from a bird dropping. The eggs hatch into worms that prevent the snail's own reproduction. Instead, the infected snail nourishes the growing larval worms, which eventually develop into a free-swimming stage and leave the snails to seek their second, or intermediate, host.

"Depending on the worm species, the intermediate host might be a crab, fish, bird, or another species of snail," **Lafferty** noted. The most common salt-marsh trematode infects California killifish. By traveling to the fish's brain, the worm causes the fish to behave differently from other killifish. "An infected fish will sometimes move about jerkily near the water's surface, turning on its side and flashing its light-colored belly. This behavior attracts predators like herons; capturing infected fish is 10 to 30 times easier for the heron than capturing healthy fish," **Lafferty** said.

The heron, in turn, becomes the host to the adult worm, said **Lafferty**. The adult trematode takes up final residence in the bird's gut, releasing thousands of eggs that are deposited by way of bird droppings back into the salt marsh, completing the life cycle of the parasite.

The scientists will use mathematical models, molecular tools, laboratory experiments, field experiments, and large-scale comparative field studies in their investigation. In addition to work at two UCSB natural reserves, Carpinteria Salt Marsh and Coal Oil Point, research will take place in estuaries in California's Morro Bay and Mugu Lagoon, along the Pacific Coast of Baja California, Mexico, and in Japan.

*Parasite ecologists are studying the health of this salt marsh at Bahia Falsa de San Quitin, Baja, Mexico. Photo by **Kevin D. Lafferty**, USGS.*

While this research is specifically geared toward understanding the role of parasites in a functioning ecosystem, another study is examining how altered parasite communities may place wildlife at risk.

"Understanding the way disease influences wildlife populations is an important tool for addressing conservation questions," **Lafferty** said. Writing in the June issue of *Conservation Biology*, **Lafferty** and **Leah Gerber**, an assistant professor at Arizona State University, Tempe, found that an important step in determining a wildlife population's status and designing recovery measures for a population at risk of becoming endangered or extinct is to analyze a species' vulnerability to infectious disease.

*Segment of a bird intestine filled with acanthocephalan worms. When in a sea otter, the worms can bore through the intestinal wall and cause death. Photo by **Kevin D. Lafferty**, USGS.*

"Not all diseases will be of concern for the conservation of a species," **Lafferty** points out. "We examined situations in which disease affected rare species or caused common species to become rare. In most cases, ironically, diseases specific to rare species tend not to be so much of a problem as environmental changes occur, because when individual animals become increasingly isolated from one another as their population numbers decrease, transmission of infectious diseases becomes more difficult."

Yet, cautions **Lafferty**, introduced, nonnative diseases can and do put a species at risk. For example, he said, rare species are likely to be most affected by diseases normally found in domestic animals.

When California sea otters were hunted to the brink of extinction by the fur trade, **Lafferty** suggests, their natural diseases may also have been largely eliminated. The remaining California otters increased in the 20th century and expanded their range, but in recent decades, they have become accidental hosts for several non-otter

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diseases, parasites for which they are not a natural host.

"These are among diseases that are newly emerging owing to human changes to the environment," said **Lafferty**.

Examining data from necropsies conducted by pathology teams between 1967 and 1989, **Lafferty** and **Gerber** found that nearly half of the stranded-sea-otter deaths were associated with disease. A significant percentage—26 percent—of deaths came from diseases that do not normally occur in sea otters.

Many sea otters (14 percent) died from being infected by a parasitic acanthocephalan worm found in sand crabs the sea otters ate when other, more natural prey was scarce. The acanthocephalan worm normally completes its life cycle when the sand crab is eaten by a shorebird. In sea otters, however, the parasite punctures the intestines, leading to peritonitis, an often-fatal infection. **Lafferty** and **Gerber** found that years in which the acanthocephalan worms were common were followed by years with high sea-otter mortality, suggesting that this parasite contributes to high death rates that can lead to reduced population growth in otters.

Other otters (8 percent) died from protozoan parasites called *Toxoplasma gondii,* which they acquired from cat feces that had been washed to sea. Cats are the usual final host of this protozoan, but other mammals—including humans—and birds can become intermediate hosts. This parasite causes toxoplasmosis, a flulike disease that is known to change behavior in its host and can alter personality in infected humans. Recent research indicates that the otters' risk of this disease is highest in areas where freshwater runoff enters sea-otter habitat.

In addition, some (4 percent) of the sea otters the researchers examined had suffered from valley fever. They were infected in the same manner as humans are, by inhaling spores of a soil fungus in dust blown to sea from construction and agriculture.

Although **Lafferty** and **Gerber** found that disease is an important factor in limiting sea-otter population growth, researchers have not been able to determine yet whether disease is driving the recent California sea-otter decline. Entanglement or entrapment in coastal fishing gear, starvation, disease, and contaminants may all have contributed to the recent sea-otter decline, say USGS sea-otter researchers.

Lafferty and **Gerber** suggest that less exposure to contaminants that could suppress otter immune systems, and to dust and sewage, could help the otters better resist disease. However, there may be no way to prevent infection from acanthocephalan worms, the most prevalent of the new diseases.

Lafferty warns that other diseases may emerge as risks to California sea otters in future years. "Canine distemper virus is a possibility, and if the otters eventually expand their range to the southern Channel Islands, they may encounter new diseases associated with warmer waters."

USGS Outreach at the "A River Runs Through It" Event: Celebrating the Hillsborough River

By Jeff Dismukes

For the first time this year, the USGS' Center for Coastal and Regional Marine Studies (CCRMS) in St. Petersburg, FL, was invited to participate in and share our science with the public at the sixth annual "A River Runs Through It" Hillsborough River event. The public event, offered to give local residents the opportunity to "get up close and personal" with the Hillsborough River, was held at the University of South Florida's Riverfront Park on May 18. Exhibits and activities were directed at informing and educating the public about the importance of the river, not only as Tampa's primary potable-water source but also as a unique ecosystem, greenway, and wildlife corridor. Sponsorship is provided by the Hillsborough River Greenways Task Force, a public/private partnership between

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The USGS exhibits informative posters and a demonstration on water quality at the sixth annual "A River Runs Through It" event. Twenty other organizations and agencies, including the Tampa Water Department, also participated.

(Hillsborough River continued from page 7)

individuals, corporations, agencies, and organizations with the goal of providing a forum, advocating science-based positions, and advancing initiatives to protect and enhance the ecologic integrity of the Upper Hillsborough River Watershed.

Many local citizens and families attended "A River Runs Through It," where they were invited to take free canoe tours of the Hillsborough River, participate in Nature Walks, be trained as Frog Listening Network Volunteers, and peruse many exhibits on environmental science and water-resource conservation. **Jeff Dismukes** and **Kate Ciembronowicz** from the CCRMS exhibited an interactive demonstration of aquifer geology in Florida, highlighting ground-water-contamination risks. Helping behind the scenes were **Pete Swarzenski**, **Pat Mullan**, **Sandy Coffman**, and **Cindee Politano**. **Jeff** noted that the demo, developed jointly for use by both the CCRMS and the USGS' Water Resources office in Tampa, FL, was a crowd pleaser for young and old alike. "It was amazing how many parents, and even young children, seemed to gain a real appreciation for Florida geology and an understanding of how our drinking water can be affected by improper disposal of contaminants. The kids were intrigued by how the water flowed and how quickly the food coloring (contaminant) spread through the ground and into the wells."

*Parents are intrigued by the demonstration of a spreading contaminant plume, while **Jeff Dismukes** answers a request from the children for a "behind the scenes" look at the model to help with science-project ideas.*

Kate and **Jeff** also reported many requests for posters and other printed material from several local educators in attendance. The USGS even received a special plug from the musical performer at the event, who was, himself, a former USGS employee. (Maybe there really is life after science!) Overall, the public expressed a great deal of appreciation for the USGS involvement in this event.❁

***Jeff Dismukes** demonstrates aquifer geology to a captivated elementary school student while her father peruses some information sheets on a wide variety of subjects.*

Lecture to Science Teachers on Climate-Change Effects on Coastal Systems

By Becky Deusser

In July 2002, as an invited speaker to a class of Massachusetts public school teachers enrolled in a two-week summer course, **Jeff Williams** (Woods Hole Field Center) spoke at the Waquoit Bay National Estuarine Research Reserve on Cape Cod. In addition to the teachers, staff from the reserve also attended the presentation. The talk focused on coastal processes, hazards associated with developed coasts, the science behind climate-change predictions, likely effects of future sea-level rise, and the options available for dealing with coastal erosion. A lively period of discussion followed the lecture.❁

Coral-Reef Meeting Held in St. Petersburg

By Don Hickey

Chuck Birkeland and **Jim Parrish** (USGS, Honolulu, HI) and **Ginger Garrison** and **Bob Halley** (USGS, St. Petersburg, FL) hosted the U.S. Geological Survey's Coral Reef Science Plan planning meeting on June 19 and 20 at the Holiday Inn in St. Pete Beach, FL. The goal was to structure the Straw Coral Reef Science Plan into a 10-year USGS Coral Reef Program. All disciplines within the USGS were represented, with additional participation from the National Park Service, the Fish and Wildlife Service, the Minerals Management Service, the National Oceanic and Atmospheric Administration (NOAA), the Florida Marine Research In-

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stitute, the Florida Institute of Oceanography, and the University of South Florida.

The first day involved introductions and informative presentations of coral-reef concepts, with the underlying theme of how the USGS could use the information to build a comprehensive coral-reef program.

- **Caroline Rogers** of the USGS' Biological Resources Discipline (BRD) presented a broad overview of past and present USGS coral-reef research, as well as possible future directions.
- **Bob Halley** of the USGS' Geologic Discipline (GD) followed **Caroline's** presentation with a demonstration on the infinite possibilities of coral-reef characterization.
- **Larry Langebrake**, Director of the Center for Ocean Technology at the University of South Florida, provided a large-scale view of the future of marine sensing using Micro-Electro-Mechanical Systems (MEMS).
- **Ginger Garrison** (USGS, BRD) discussed the environmental and anthropogenic perturbations and emerging threats to coral-reef environments.
- **Cheryl Woodley** of NOAA's Center for Coastal Environmental Health and Biomolecular Research provided insight into their molecular approach with respect to investigating some of the stresses discussed by **Ginger**.
- **Chuck Birkeland** (USGS, BRD) and **Jim Parrish** (USGS, BRD) contributed their expertise on the importance of marine protected areas (MPAs) and how such areas will benefit coral-reef environments and national parks.
- **John Ogden**, Director of the Florida Institute of Oceanography in St. Petersburg and mediator for the planning meeting, provided the final presentation, titled "Science, Policy, and the Future of Coral Reefs."

The second day of the meeting entailed the presentation, discussion, modification, and prioritizing of the Straw USGS Coral Reef Science Plan. USGS managers and scientists discussed appropriate issues and content that should be addressed within the proposed 10-year plan.

A select few were chosen for the writing team and were given the substantial task of completing a printed version of the USGS Coral Reef Science Plan.

The meeting was a great success, thanks to the hard work of all participants.

UsSEABED Continues to Expand Coverage and Usage for Mapping Seabed Characteristics

By Jane Reid and Jeff Williams

Representatives from the USGS' Coastal and Marine Geology Program (CMGP), the National Oceanic and Atmospheric Administration (NOAA)'s National Geophysical Data Center (NGDC), and the Institute of Arctic and Alpine Research (INSTAAR) at the University of Colorado, Boulder, met in Boulder in late June to discuss the ever-expanding marine-sedimentary data coverages held within usSEABED. An information-processing system for diverse types of sea-floor data, usSEABED is the collaborative effort of CMGP, INSTAAR, and NGDC. The meeting was attended by **Jeff Williams** (Woods Hole, MA), **Jane Reid** (Santa Cruz, CA), and **Jim Flock**s (St. Petersburg, FL) for the USGS, **George Sharman** and **Carla Moore** for NGDC, and **Chris Jenkins** for INSTAAR. It provided discussions between the primary agency for archiving marine-geologic data (NGDC), the agency tasked with making scientific, analytical, and interpretive products (USGS), and the group that facilitates the connection between the two (INSTAAR).

Started in 1999 on the West Coast, usSEABED has expanded in the past year to the East and Gulf Coasts through its use by CMGP's Benthic Habitats and Marine Aggregates (sand and gravel) projects; it now contains more than 100,000 processed data points and an untold number of potential data sources. Given this new breadth of coverage and the proposed Regional Synthesis task for the central Gulf Coast and the Gulf of Maine in 2003, the three groups collaborating on usSEABED are eager to coordinate their efforts more closely and strengthen their collaborative ties.

The implementation of a recent memorandum of understanding between INSTAAR and the USGS facilitates the expansion of usSEABED data into the third dimension (depth below the sea floor) by using currently held sediment-core data and by correlating core data with geophysical data. These correlations will be used by the Marine Aggregates project and, eventually, by many other CMG projects.

In 2003, scientists in the Benthic Habitats project will continue to use usSEABED for making maps of sea-floor habitats and sediment grain size, thickness, and other properties. Scientists in the Marine Aggregates project will use usSEABED to identify potential offshore sources of sand for shoreline restoration in four pilot regions—the New York Bight, south-central Louisiana, Hawaii, and the Gulf of Maine—and choose areas for higher-resolution surveys.

A Web site describing usSEABED is under development and will list the data sets included, but other sediment data sets from around the United States are being sought. Other collaborators interested in contributing to usSEABED are encouraged to contact **Jane Reid** (**jareid@usgs.gov**).

Lake Mead Poster Receives High Honors

By Becky Deusser

The Society for Sedimentary Geology (SEPM, after original name "Society of Economic Paleontologists and Mineralogists") has awarded **Dave Twichell** of the Woods Hole Field Center (WHFC) its 2002 Excellence in Poster Presentation award for "superior work" with his poster "Mapping Turbidites in Lake Mead from Source to Sink." The poster was coauthored by **VeeAnn Cross** (WHFC) and **Mark Rudin** (University of Nevada, Las Vegas). The award will be presented in May 2003 during the AAPG/SEPM Annual Meeting in Salt Lake City, Utah.

USGS Emeritus Roland von Huene Receives Prestigious European Award

By Helen Gibbons and Dave Scholl

Roland von Huene, a USGS Emeritus Scientist with the Coastal and Marine Geology Program (CMGP), has received a prestigious award from Germany's Geologische Vereinigung, a European equivalent of the Geological Society of America.

The Gustav Steinmann Medal was presented to **Roland** at Christian Albrechts University of Kiel, Germany, in October 2001. The highest honor awarded by the Geologische Vereinigung, the Steinmann Medal honors scientific leadership and outstanding personal achievement in the Earth sciences. **Roland** received it for his illuminating research on the evolution of convergent margins where oceanic crust is being subducted beneath continental crust.

Gustav Steinmann, for whom the medal is named, was among the first to recognize that an assemblage of rocks, now called the Steinmann Trinity, records the tectonic interaction of oceanic and continental crust at a convergent margin. The trinity is a manifestation of subduction accretion—the tectonic addition of oceanic rock and sediment to the continent. Interestingly, **Roland's** research has shown that subduction erosion, rather than subduction accretion, is the main process shaping most convergent margins.

***Roland von Huene** (right), **Dave Scholl** (center), and **Roland's** wife **Juanita** (left) relax on a deck overlooking the **von Huenes'** vineyard in Camino, CA. CMGP scientist **Bill Normark** is behind the camera.*

Much of the research that led **Roland** to this discovery was conducted at the USGS, where he worked in the Branch of Pacific Marine Geology, a predecessor of CMGP, from 1967 until 1989. To his initial surprise, **Roland** found evidence of subduction erosion at numerous convergent margins, including subduction zones off Chile, Japan, Guatemala, and Peru.

In 1989, **Roland** traveled to Kiel, Germany, to become the first director of the Marine Geodynamics Division of GEOMAR, a research center for the study of the structure, development, and history of the ocean floor and its interaction with seawater. With the help of colleagues at GEOMAR, **Roland** assembled definitive evidence that subduction erosion, with its sister process sediment subduction, is a major factor in the shaping of convergent margins.

Roland's friend and colleague, **Dave Scholl**, also a USGS Emeritus Scientist with CMGP, delivered a tribute to **Roland** at the awards ceremony in Germany last October. That tribute was published in the International Journal of Earth Sciences (v. 91, p. 369–371) and can be viewed online at URL **http://link.springer.de/link/service/journals/00531/contents/01/00256/paper/.**

Cheryl Hapke's Thesis Defense at the University of California, Santa Cruz

Cheryl Hapke, of the Coastal and Marine Geology Program (CMGP), successfully defended her Ph.D. thesis in Earth sciences at the University of California, Santa Cruz (UCSC), on July 18. Her presentation went very well, according to thesis advisor **Gary Griggs**, a professor of Earth sciences and Director of the Institute of Marine Sciences at UCSC.

Cheryl's thesis research focused on using the most current high-precision photogrammetry and geographic-information-system (GIS) methods to determine the spatial and temporal scale of coastal land loss and coastal-erosion rates. She worked on several different but related problems. For example, she quantitatively

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assessed the significance of episodic events (such as the 1997-98 El Niño and the 1989 Loma Prieta, Calif., earthquake) on coastal-cliff failure in the northern Monterey Bay area. Then she compared these episodic events to long-term (50 yr) cliff-erosion rates determined by former CMGP scientist **Laura Moore** (St. Petersburg, FL) when she was a Ph.D. student at UCSC. **Cheryl** was able to show that episodic events are extremely important in accounting for the long-term erosion rates. She also worked on a second project along the Big Sur Coast Highway (a segment of California Highway 1), where she used photogrammetry to determine areas of hillslope degradation and accumulation to assess the overall volumetric importance of slope failures along this steep coastline. This project was an attempt ultimately to discover whether slope failures in the vicinity of California Highway 1 are significant components of overall sediment contributions to the nearshore waters of Monterey Bay National Marine Sanctuary.

Cheryl's dissertation is entitled "Multi-Scale 3D Mapping of Coastal Cliff Erosion and Coastal Landslides in Central California: Applications in Digital Photogrammetry and GIS." Much of her research on coastal landslides has been funded by the California Department of Transportation (Caltrans), and she will give a presentation at the National Highway Geology Symposium in San Luis Obispo, CA, in August.

New Employees at Woods Hole Field Center

Madhavi Mamidipalli, a graduate student in computer sciences at Western Kentucky University, has joined the Woods Hole team as an Environmental Careers Organization (ECO) contractor. **Madhavi** will be working with **Page Valentine** to modify existing databases and to develop a new database that will support a benthic-habitat classification system for New England and eastern Canada.

Joel Moore has departed for graduate school in the Geosciences Department at Pennsylvania State University after almost 2 years as an ECO intern on the New York and Long Island Sound Regional Pollution projects. He is replaced by **Sandy Baldwin**, who recently graduated in geoscience from Hobart and William Smith Colleges, NY, where she also participated in numerous limnology research projects.

Dirk Koopmans also joined the pollution studies team in July and will assist with production of maps and publications. **Dirk** has an M.S. in marine sciences from the University of Georgia and a B.S. in natural resource management from Cornell University, and he has worked on various oceanographic, watershed, and ecosystem geochemical projects.

Irina Abramson is in Woods Hole as the Wesleyan Summer Intern. She recently graduated in Earth and environmental sciences from Wesleyan University in Middletown, CT, where she participated in collaborative USGS studies on foraminifers in Long Island Sound sedimentary deposits.

2002 Summer Interns at Woods Hole Field Center

By Kristen McKee

The Woods Hole Field Center welcomed four interns in June: **Marcie Palmer**, **Takitta Childress**, and **Kristin McKee** have joined the Coastal and Marine Geology Program (CMGP), and **Nina Carranco** will be working with USGS research scientists as a Summer Student Fellow in the Woods Hole Oceanographic Institution Summer Research Seminar.

Nina will focus on fisheries in the Gulf of Maine as she studies the effects of science on public policy under the guidance of **Fran Lightsom**. **Nina** graduated from Pomona College with a degree in geology in May 2002. Upon completion of her research, **Nina** will return to her hometown of Seattle, WA, and plans to enter graduate school in fall 2003 to study paleoecology.

Marcie will use her graphic-design skills to develop a user-friendly interface design for the Marine Realms Information Bank (MRIB) under the CMGP National Knowledge Bank project. **Marcie** will also work with the language aspect of the MRIB to clarify the methodology of the digital library for the public. Originally from Dearborn Heights, MI, **Marcie** is a senior at the University of Michigan studying graphic design and English literature. After graduation, **Marcie** plans to attend graduate school in one of these fields.

Takitta has joined the CMGP team to redesign and improve the usability of the MRIB. **Takitta's** past work in networking and computer troubleshooting will aid her as she learns the Web-development skills necessary for this position. The Simpsonville, SC, native is majoring in computer information systems at Hampton University and expects to graduate in May 2003. After graduation, **Takitta** will pursue an M.B.A. in management information systems.

Hired to improve the content clarity of the MRIB, **Kristin** hopes to do plenty of writing for the USGS and to work with the graphic design of the MRIB. Hailing from Rochester, NY, **Kristin** is a sophomore at Northwestern University double-majoring in journalism and economics, with a minor in African-American Studies. After graduation, she plans to study law.

Marcie, **Takitta**, and **Kristin** are all working under the guidance of **Fran Lightsom** and **Fausto Marincioni**. These women were hired through the Diversity Internship Program of the Student Conservation Association, a program geared toward helping minority and female students find internships in the environment field.

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