USGS

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Research

USGS Launches Multidisciplinary Investigation of Northeast Pacific Sea Otter Populations and Nearshore Ecosystems

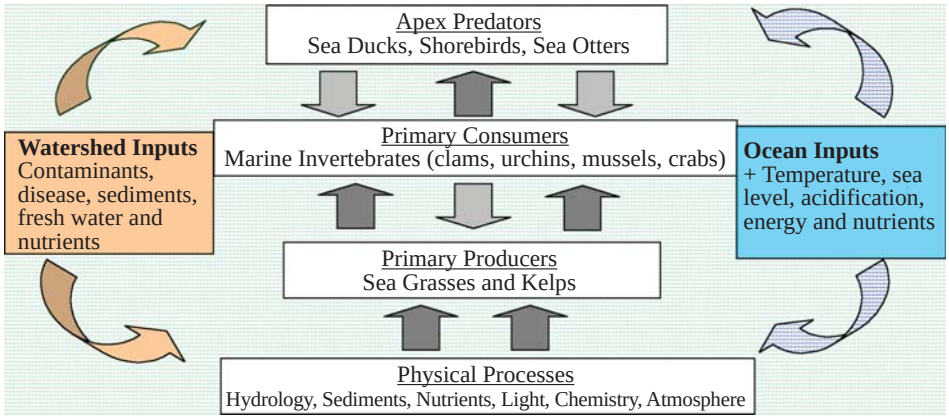
By Jim Bodkin, Christian Zimmerman, Dave Douglas, Keith Miles, Lizabeth Bowen, Tim Tinker, William Perry, Lyman Thorsteinson, Mike Murray (Monterey Bay Aquarium), Seth Newsome (University of Wyoming), and Linda Nichol (Fisheries and Oceans Canada)

*Sea otter in Simpson Bay, Prince William Sound, Alaska, 2002. The sea otter is a keystone species that plays a critical role in maintaining the structure and health of its ecosystem. Photograph © **R. Davis**, Texas A&M University.*

Sea otters and the nearshore ecosystems they inhabit—from highly urbanized California to relatively pristine Alaska—are the focus of a new multidisciplinary study by scientists with the U.S. Geological Survey (USGS) and their collaborators. Titled "Coastal Ecosystem Responses to Influences from Land and Sea," the project will investigate the many interacting variables that influence the health of coastal ecosystems along the Northeast Pacific shore.

At the interface between oceans and continents, coastal ecosystems are shaped not only by processes unique to the nearshore environment but also by influences from the neighboring sea and land. Influences from the open ocean include currents that deliver nutrients (such as nitrogen and phosphorus) and food resources (such as phytoplankton—"primary producers" that convert inorganic material and sunlight into biomass—and zooplankton, which transfer that biomass to animals higher in the food web). Ocean influences also include factors that challenge the present-day equilibrium, such as ocean acidification, sea-level rise, and ocean warming. Coastal ecosystems receive freshwater, sediments, and additional nutrients from the land, which can impose challenges that include pollutants and pathogens associated with burgeoning human populations.

Our understanding of the physical processes that cause climate change, sea-level rise, and ocean acidification is advancing, thanks to accumulating data and refined computer models; but the implications for biological systems are only beginning to be explored. To improve our understanding of the factors affecting nearshore biological communities, the new USGS project is focusing on sea otter populations in the Northeast Pacific. Sea otters occur in geographically separate populations that span more than 30° of latitude and vary in status from gradually increasing to declining. In the sea otters' food web, the primary producers are kelps (large seaweeds belonging to the class of brown algae); and food energy is transferred through benthic (bottom-dwelling) invertebrates, such as clams, crabs, mussels, and urchins,



Simplified nearshore marine food web, in which kelps and sea grasses provide primary production and benthic invertebrates transfer energy to apex consumers. Dark arrows indicate transfer of energy upward, and light arrows indicate consumption and predation. Curved arrows indicate inputs from terrestrial and oceanic sources into the nearshore.

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Sound Waves

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Deadline: The deadline for news items and publication lists for the June issue of *Sound Waves* is Wednesday, April 14.
Publications: When new publications or products are released, please notify the editor with a full reference and a bulleted summary or description.
Images: Please submit all images at publication size (column, 2-column, or page width). Resolution of 200 to 300 dpi (dots per inch) is best. Adobe Illustrator© files or EPS files work well with vector files (such as graphs or diagrams). TIFF and JPEG files work well with raster files (photographs or rasterized vector files).

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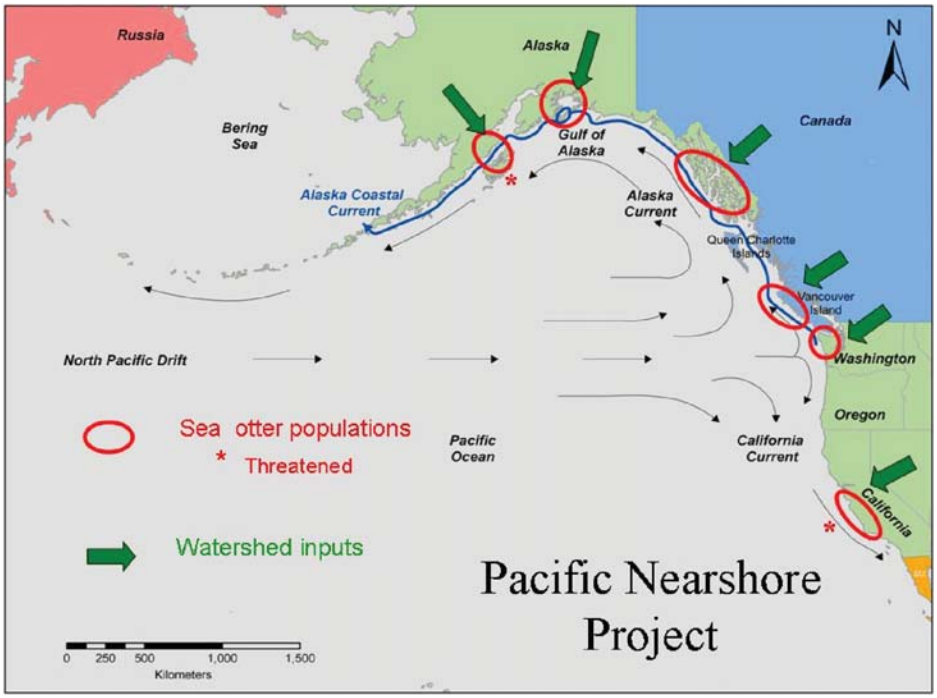
Research, continued

(Nearshore Ecosystems continued from page 1)

to high-level consumers, such as fishes, birds, and mammals. The sea otter is an apex predator (at the top of its food web) and a keystone species. Just as an arch will collapse if the keystone at its top is removed, an ecosystem will change drastically if a keystone species is removed. Sea otters serve as a focal point for understanding the variables that influence their ecosystem—sea otters integrate the combined effects of watersheds, oceans, and the nearshore environment into their diet, behavior, condition, and health, which is ultimately reflected in their abundance and population trends over time.

The USGS-led study will contrast six geographically distinct sea otter populations, including two populations listed as "threatened" under the Endangered Species Act, to identify factors contributing to variations in the animals' density and abundance. The study design incorporates ecosystem productivity (both oceanic and nearshore), watershed inputs, and sea otter diet and nutrition as primary factors potentially regulating population abundance and growth rates. Ecosystem productivity will be estimated by measuring growth rates of nearshore fishes and by analyzing remotely sensed data—including such data as ocean temperature and chlorophyll concentrations provided by satellite imagery (for example, from the Landsat and MODIS [Moderate Resolution Imaging Spectroradiometer] programs), and air temperature and wind velocity provided by oceanographic stations. Human modifications of the watershed and terrestrial inputs into the nearshore will be estimated by analyzing remotely sensed data, including satellite imagery, as well as data collected by hydrographic stations (which measure such variables as rainfall, streamflow, and the concentration of certain chemicals in stream water). Sea otter diet and nutrition will be estimated through direct observation of foraging animals and analysis of stable isotopes obtained from whiskers.

(Nearshore Ecosystems continued on page 3)



Geographic bounds and conceptual components of USGS Pacific nearshore-ecosystem study, including six geographically distinct sea otter populations (from west to east, Katmai, Prince William Sound, Southeast Alaska, British Columbia, Washington, and California). The study design integrates several decades of USGS research on sea otter populations and the results of recolonizations and reintroductions, which have resulted in separate populations across a gradient of human perturbations to watersheds.

(Nearshore Ecosystems continued from page 2)

Concurrently, the researchers will use noninvasive, gene-expression technology to evaluate the health and condition of sea otters relative to the nearshore ecosystem. When a gene is "expressed" in response to stressful stimuli, it produces genetic material (messenger RNA, or mRNA) that instructs cells to produce proteins that combat the ill effects of the stimuli. Specific pollutants and pathogens are known to activate certain genes, and by identifying and quantifying the mRNA products, researchers can use gene expression in concert with clinical evaluation to best diagnose an organism's state of health relative to exposure to contaminants or diseases. As part of this new project, blood samples collected from sea otters in each population will be analyzed for evidence of genes expressed by organic pollutants, metals, parasites, bacterial infection, viral infection, injury, and thermal stress (difficulty in maintaining body temperature due to, for example, contamination of fur by spilled oil).

The combined data sets on nearshore and ocean productivity, watershed inputs, sea otter diet and nutrition, and sea otter gene expression will support the analysis of a complex array of interacting variables likely responsible for the present status of each of the six sea otter populations and, by inference, the health and condition of their nearshore ecosystems.

The data acquired by this study will inform and support future modeling efforts to forecast nearshore ecosystem responses to anticipated environmental change, such as increasing air and sea temperatures, sea-level rise, ocean acidification, contaminants, and disease.

Key partners in this study include the U.S. Fish and Wildlife Service, the National Park Service, the Minerals Management Service, the Exxon Valdez Oil Spill Trustee Council, the North Pacific Research Board, Fisheries and Oceans Canada, the University of Wyoming, the Washington Department of Fish and Wildlife, the California Department of Fish and Game, and the Monterey Bay Aquarium.

To learn more, please visit **http://alaska.usgs.gov/science/doi_landscape/bodkin.html**. ☸

*Veterinarian **Mike Murray** (Monterey Bay Aquarium; left) and **Jim Bodkin** record a sedated sea otter's vital signs and prepare to take a blood sample for gene-expression analysis, which will reveal information about the animal's exposure to pollutants and disease. The animal will be released after it has been examined and tagged and the sedative has been reversed. Photograph taken August 2009, aboard the research vessel* Norseman *off the Kenai Peninsula, Alaska.*

***Liz Bowen** conducts gene-expression analysis on sea otter blood samples at the University of California, Davis, September 2009.*

*Phytoplankton bloom (water that looks turquoise) near the coast of Vancouver Island, British Columbia, Canada. Image collected by MODIS (Moderate Resolution Imaging Spectroradiometer) on the Aqua satellite, June 25, 2006, processed by **Jeff Schmaltz**, NASA Visible Earth (**http://visibleearth.nasa.gov/view_rec.php?id=20904**).*

*Sea otter mother and pup in Simpson Bay, Prince William Sound, Alaska, 2002. The new USGS research will be used to understand and quantify the influence of ecosystem productivity, food limitation, and human sources of pollution and infectious disease on sea otter populations. Photograph © **R. Davis**, Texas A&M University.*

***George Esslinger** (USGS; left) and **Heather Coletti** (National Park Service) use spotting scopes in 2006 to observe sea otters in Glacier Bay, Alaska, and determine what they are eating.*

USGS Sediment-Transport Investigators Calibrate Tripod-Mounted Underwater Sonars in a Large Tank at the University of New Hampshire

By Ellyn Montgomery, Marinna Martini, and Chris Sherwood

To assess and study the mechanisms of seafloor change in coastal regions, the Sediment Transport Group of the U.S. Geological Survey (USGS) Woods Hole Coastal and Marine Science Center (Woods Hole, Massachusetts) deploys instrumented tripods on the seafloor. Among the instruments commonly mounted on the tripods are sonars used to measure sand waves of various scales and document how they change over time. The data collected by these tripods are commonly employed in models that predict what conditions will cause sediment motion, as well as how much sediment is likely to be transported and in which direction. Coastal planners and environmental engineers can use such information to determine beach maintenance or enrichment needs, choose sites for barrier placement, and make various other management decisions.

Chris Sherwood *(left) and UNH master's degree student* ***Gary Margelowsky*** *measure instrument positions and record tripod feature locations. The fan-beam sonar is visible in the top left of the image.*

Sonars work by emitting sound energy and detecting the resulting echoes, in this case, the reflections from features on the seafloor. The geometry of the sonar returns is complicated by transducer tilt, tripod movement during storms, and some calibration factors in the instrument settings. To better understand the sonar data, **Chris Sherwood**, **Ellyn Montgomery**, **Marinna Martini**, **Dann Blackwood**, and **Michael Casso** went to an engineering tank at the University of New Hampshire (UNH) Jere A. Chase Ocean Engineering Center (**http://www.unh.edu/oe/facilities/engineeringtank.htm**).

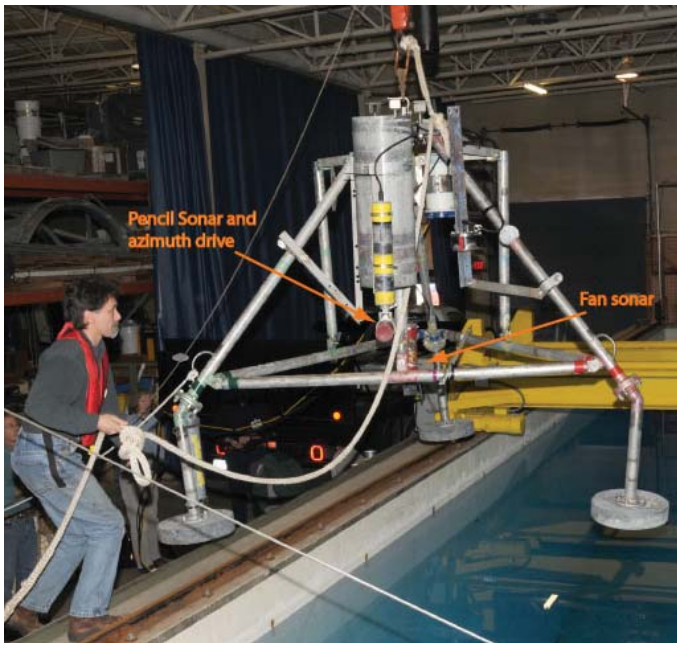
The tank is 60 ft long by 40 ft wide, 20 ft deep, and filled with clear, cool New Hampshire groundwater. The indoor facility has power, cranes for moving equipment, and dive facilities. The sonars were calibrated in the tank by using targets of known location, size, and shape. The locations and orientations of the instruments on the tripod were carefully measured and mapped before the tripod was submerged in the tank. Target placement was designed to answer specific questions, and each target arrangement was measured and documented in the tank. Comparison between the target maps and the sonar images allowed us to verify calibration coefficients and check the geometric corrections.

We tested five arrangements of targets, each designed to quantify one or more aspects of sonar resolution. The divers (**Blackwood** and **Casso**, assisted by UNH student **Sean Denny**) placed targets around the tripod and surveyed their locations. Then we recorded sonar data, uploaded it from the datalogger used during autonomous deployments, converted it to image format, and assessed our ability to relate the images to the target pattern. This form of ground-truthing is very important for the correct interpretation of any sonar data we collect.

During the tests, the accuracy of the measurements of two types of sonars was assessed:

- Pencil-beam sonar with azimuth drive (Imagenex 881A imaging sonar): Works like a depth finder and measures the distance to points on the seafloor at a series of positions along a line under the transducer head. The height determined for each point depends on the azimuth (direction in the horizontal plane) and vertical angle of the pencil beam, as well as on the orientation of the sonar head.
- Fan-beam sonar (Imagenex 881 tilt adjust imaging sonar): Detects echoes from the seafloor along outward-directed lines as it rotates. The fan beam produces an almost photographic image of the bottom that is especially useful for measuring ripple wavelength and orientation, but one that must be correctly oriented and corrected for slant before quantitative analysis.

(Sonar Calibration continued on page 5)



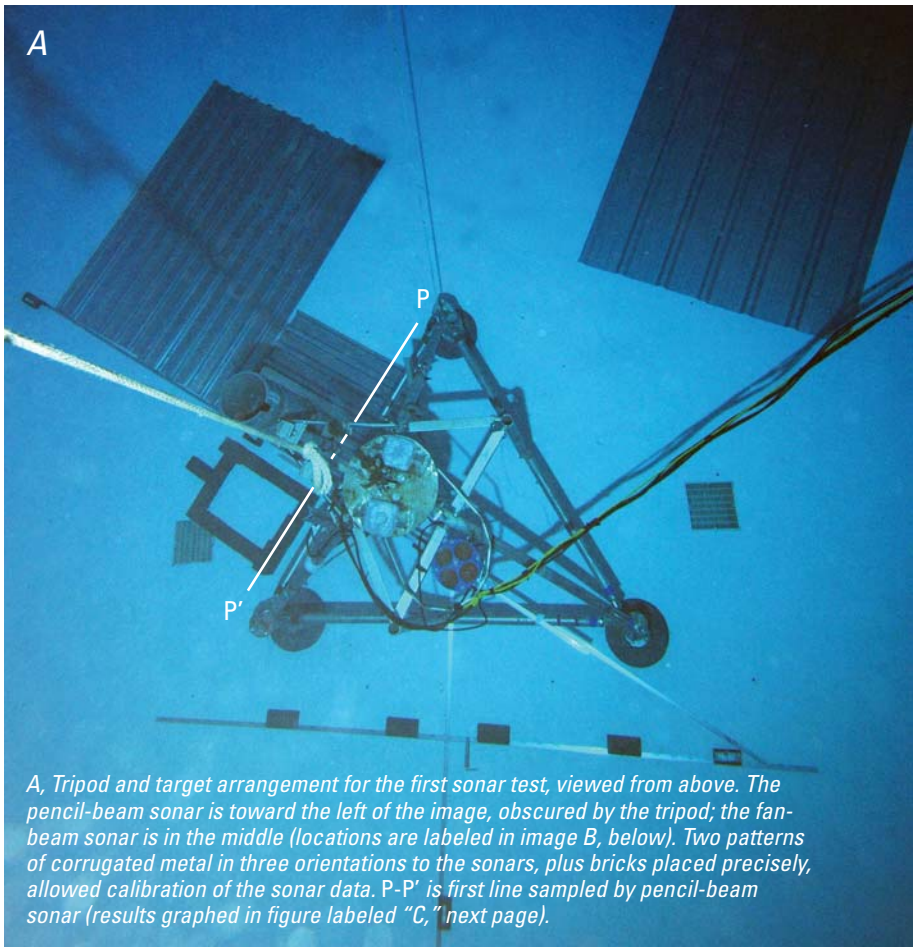
Andy McLeod *of UNH deploys our tripod in the tank. Painted stripes identify each tripod leg; "red leg" is on right, suspended above the water; "green leg" is on left; "blue leg" is in back, largely hidden by instruments.*

(Sonar Calibration continued from page 4)

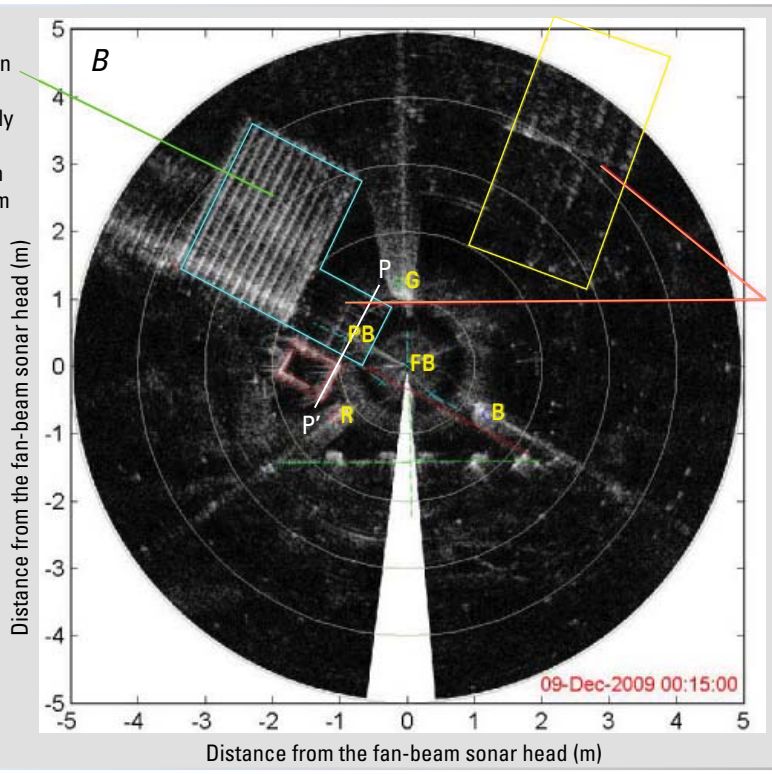
Our targets were inexpensive, acoustically reflective, and nonbuoyant: sheets of corrugated-metal roofing with various undulating patterns, and bricks. The divers created five different configurations in the tank, arranged so that the effects of distance from the sonar, the angle of incidence to the ridges in the roofing, and the tripod tilt could all be documented and the targets carefully measured for comparison with the data. The photograph at right (labeled "*A*") shows the tripod in the tank from above, with the targets arranged for the first test. The graph below (labeled "*B*") shows the fan-beam sonar image from that arrangement—the fan-beam transducer is located at image center. Note that most of the targets are visible in the fan-beam sonar image, but ripples that are oriented perpendicular to the radial fan-beam scans are much more distinct, or better resolved, than those oriented parallel to them.

The piece of corrugated-metal roofing under the pencil-beam sonar (labeled "PB" in figure *B*) was oriented so the ridges and troughs were approximately parallel to the radial fan-beam scans (making the piece

(Sonar Calibration continued on page 6)



A, Tripod and target arrangement for the first sonar test, viewed from above. The pencil-beam sonar is toward the left of the image, obscured by the tripod; the fan-beam sonar is in the middle (locations are labeled in image B, below). Two patterns of corrugated metal in three orientations to the sonars, plus bricks placed precisely, allowed calibration of the sonar data. P-P′ *is first line sampled by pencil-beam sonar (results graphed in figure labeled "C," next page).*



B, Example of processed fan-beam image from targets in photograph A, showing how resolution quality varies with orientation of ridges in corrugated-metal targets. Note that ridges oriented perpendicular to the radial fan-beam scans are much more distinct than those oriented parallel to the scans. B, *blue leg;* FB, *fan-beam sonar;* G, *green leg;* PB, *pencil-beam sonar;* R, *red leg.* P-P′ *is first line sampled by pencil-beam sonar (results graphed in figure labeled "C," next page).*

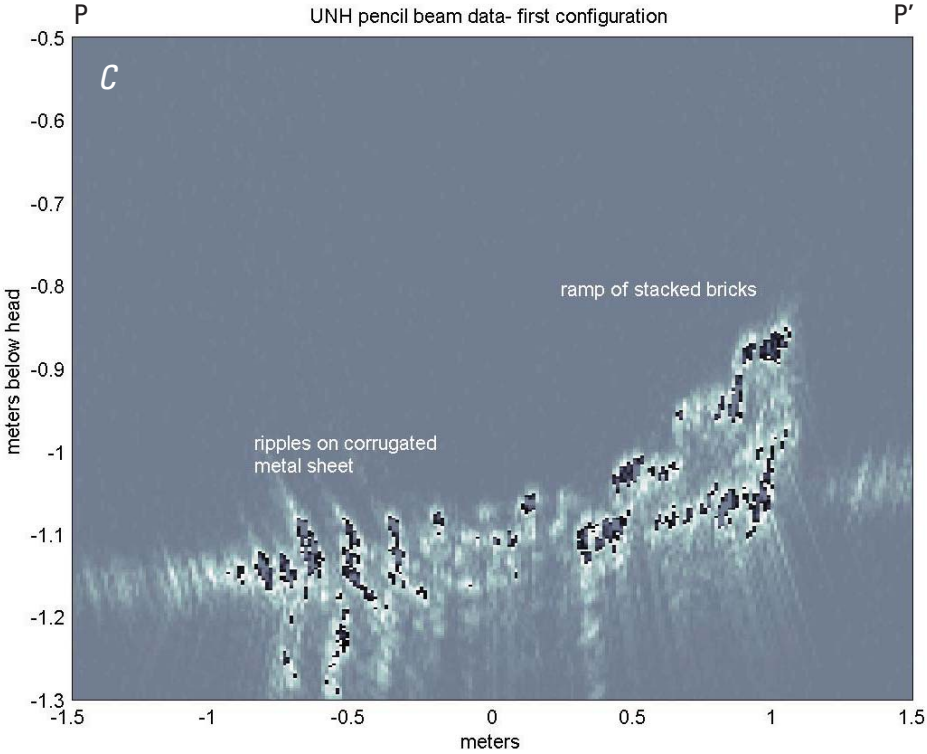
(Sonar Calibration continued from page 5)

difficult to see in the fan-beam image) but perpendicular to the line sampled by the pencil-beam (line P-P'). The plot at right, labeled "*C*," shows the ridges and troughs of the roofing and brick targets detected during the pencil-beam sweep. This image has not been corrected for a slight tilt to the sensor, resulting in the base not being parallel to the x-axis, but the heights of the features match what we expect from the measurements, validating that our software applies the correct calibrations.

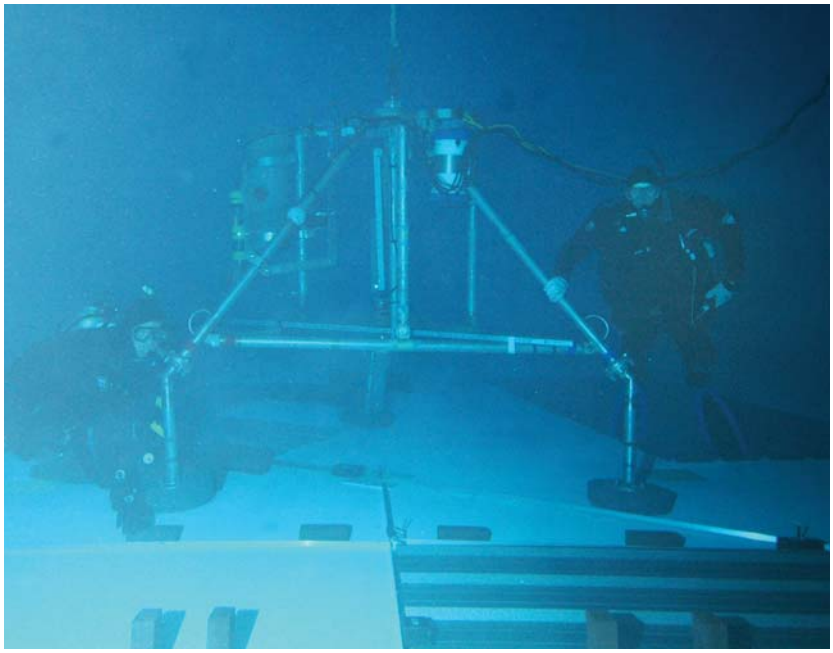
Our final test focused on the fan-beam sonar, which is typically configured to make two sets of radial scans for every sample, one clockwise, then one counterclockwise. The two views should overlie, but our testing revealed a slight offset between the actual and reported head positions, resolving questions raised in interpreting field data. The photograph below shows divers after setting up the fifth arrangement of bricks, designed to help us quantify the offset between the clockwise and counterclockwise cycles and calculate appropriate corrections.

We have already improved our software, which converts the raw scan data into images. We will also be able to ensure that our programs properly account for sensor and seafloor tilts when we compare two configurations with differing tripod tilts. By using corrugated-metal targets to simulate ripples of two length scales, we also expect to improve the ability of our software to accurately determine ripple wavelength and direction. We're looking forward to using these enhanced methods to interpret the sonar data collected during several recent field programs.

We thank our wonderful hosts at the University of New Hampshire, particularly **Andy McLeod** and graduate student **Gary Margelowsky**. This huge and well-maintained facility provided the ideal venue for our experiment.



C, Processed pencil-beam sonar image showing targets detected by the first pencil-beam sweep, along line P-P' *in figures A and B (previous page). The heights of the bricks and the ripples on the corrugated metal are consistent with measurements made before the run. The overall tilt of the reflections off the targets is due to the transducer center not being perfectly vertical. The transducer is surprisingly difficult to install with perfect accuracy, so developing methods to correct for slight offsets is important.*



Divers pose for a picture with the last addition to the targets in the fifth arrangement. This configuration was used to quantify an offset between clockwise and counter-clockwise sweeps of the fan-beam sonar.

A Different Delta Force—USGS and U.S. Department of State Assist in the Mekong Delta

DRAGON
Delta Research And Global Observation Network
PROJECT

By Gabrielle B. Bodin

The U.S. Geological Survey (USGS) is bringing its broad scientific understanding of the Mississippi River Delta to bear on a similar river delta half a world away, the Mekong River Delta of Southeast Asia.

Through the U.S. government's Lower Mekong Initiative, the USGS Delta Research and Global Observation Network (DRAGON) Partnership will use its experience with the Mississippi River and its expertise in Earth-science modeling to help the Mekong countries assess how climate change and human activities could affect the ecology and food security of the Mekong Basin. Despite a geographic difference of 12 time zones, the Mississippi and Mekong River Deltas share many cultural, economic, and ecological similarities.

The Intergovernmental Panel on Climate Change (IPCC) reported in its 2007 fourth assessment that nearly 300 million people live in a sample of 40 deltas worldwide, including all the large deltas. "Deltas, one of the largest sedimentary deposits in the world, are widely recognized," the report stated, "as highly vulnerable to the impacts of climate change, particularly sea-level rise and changes in runoff, as well as being subject to stresses imposed by human modification of catchment and delta-plain land use."

Last December, the USGS and the U.S. Department of State cosponsored a workshop titled "Understanding Risk and Vulnerability of Wetland Ecosystems at the Mekong and Mississippi Deltas to Climate Change and Sea-Level Rise" with the DRAGON Institute-Mekong at Can Tho University, Vietnam, December 9-11.

This workshop was part of a project whose centerpiece is "Forecast Mekong," an interactive data integration, modeling, and visualization system to help policy makers, resource managers, and the public understand and predict outcomes from climate change and development projects in the Mekong River Basin. When fully implemented by the USGS, in partnership with local governments and universities throughout the Mekong region, the Forecast Mekong program will provide a valuable planning tool to visualize the consequences of climate change and river management.

The December workshop brought together more than 75 participants to prioritize work and identify information gaps related to the Mekong Delta and climate change. Participants included scientists and government officials from Cambodia, Laos, Vietnam, Thailand, and China; representatives from the U.S. Department of State and nongovernmental organizations; and USGS scientists. Several important scientific issues emerged, including water quality and sedimentation, the impacts of hydropower development on biodiversity and food security, climate-change adaptation, changes in the timing and severity of seasonal floods, and fisheries productivity.

Next steps for the USGS will include participating in cooperative research with Mekong region scientists, providing technical expertise to facilitate data analysis and integration, conducting environmental monitoring, and creating science-visualization tools. Participants at the workshop also identified the need for training and technology transfer and the desire to establish stronger long-term collaboration with USGS scientists. The Forecast Mekong project will also help build the foundation for later activities

(Mekong Delta continued on page 8)

Despite a geographic difference of 12 time zones, the deltas of the Mekong (far left) and Mississippi (left) Rivers share many cultural, economic, and ecological similarities. Landsat imagery provided by USGS.

(Mekong Delta continued from page 7)

through strengthening relationships with Mekong region scientists and organizations, data sharing, and joint research.

Forecast Mekong is a component of the DRAGON Partnership (**http://deltas.usgs.gov/**), which was created by the USGS in December 2007 in response to Hurricane Katrina and its impact on the vulnerable Mississippi River Delta (see related article in *Sound Waves*, January/February 2008, **http://soundwaves.usgs.gov/2008/01/meetings2.html**). The devastating storm brought new urgency to the critical need to share information and data from major deltas around the world.

DRAGON creates an international community of practice among scientists and resource managers to share data on the great deltas and rivers of the world. Comparative studies are essential to understanding and predicting the effects of climate change, engineering projects, land use, hydrologic change, and other human impacts in these sensitive ecosystems. By developing comparative models and visualization tools, the DRAGON partners aim to help inform public-policy decisions that will affect delta inhabitants and ecology.

The U.S.-Lower Mekong Initiative was launched in 2008 by U.S. Secretary of State **Hillary Rodham Clinton** and the Foreign Ministers of Cambodia, Laos, Thailand, and Vietnam to enhance U.S. engagement with the Lower Mekong countries in the areas of environment, health, education, and infrastructure.

Publications

New Web Site, "Maps of America's Submerged Lands," Provides Map-Based Link to USGS Map Publications with Digital Data

By Bradford Butman, Walter Barnhardt, Peter Dartnell, Greg Miller, Seth Ackerman, and Jennifer Martin

The U.S. Geological Survey (USGS) produces fundamental geologic and environmental information about submerged lands of the United States and its territories, including maps, geospatial data, and interpretations that portray the physical characteristics of the continental shelf, estuaries, and lakes. The information addresses a wide range of scientific and management issues that are important to the environment and economy of coastal communities and the entire Nation.

A new Web site, "Maps of America's Submerged Lands" (**http://woodshole.er.usgs.gov/data/submergedlands/**), is a simple, map-based portal to maps with digital data produced by the USGS Coastal and Marine Geology Program. The site provides links to published USGS maps, reports, and digital data that depict the bathymetry, surficial geology, and (or) subsurface structure of submerged areas over a wide range of scales. The digital data are available as shape files, images, or grids in geographic-information-system (GIS) format.

*Map from the new Web site "Maps of America's Submerged Lands" (**http://woodshole.er.usgs.gov/data/submergedlands/**), which provides links to maps and data published by the USGS Coastal and Marine Geology Program.*

A map on the home page shows the outlines of maps currently available. Clicking on an outline opens a small window that displays the report title and provides links to the report and to the data catalog. Users can navigate around the map by using the pan tool and can zoom in by double-clicking anywhere on the map; these actions can also be performed by using the control bar on the left of the image. Links below the map on the home page provide a bibliography of the map publications by region. Rather than creating a separate database, the Web site uses the USGS publications to serve the data. For the most part, only maps with digital data are included, and maps in progress are not shown. Maps will be added as they are published. This site provides a single location for linking to USGS Coastal and Marine Geology Program offshore maps and data, and complements the Program's Internet Map Server at **http://coastalmap.marine.usgs.gov/regional/contusa/**.

The need for comprehensive scientific information about America's submerged

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(Submerged Lands continued from page 8)

lands is increasingly recognized by researchers, policy makers, and resource managers at all levels. Reports by the Interagency Ocean Policy Task Force (2009; **http://www.whitehouse.gov/administration/eop/ceq/initiatives/oceans/interimreport**), the U.S. Commission on Ocean Policy (2004; **http://oceancommission.gov/documents/full_color_rpt/welcome.html**), and the National Research Council (2004; **http://www.nap.edu/openbook.php?isbn=0309091764**) all stress the need for scientific information to inform decision making, and the importance of regional, State, and local engagement in developing and applying science products.❁

One-Stop Online Source for Biogeographic Information About U.S. Oceans and Waters

By Mark Fornwall, John Mosesso, and Ron Sepic

A one-stop source for biological information collected from U.S. waters and oceanic regions is now available from the National Biological Information Infrastructure (NBII) Program, on its Ocean Biodiversity Information System (OBIS) - USA Web site (**http://www.nbii.gov/portal/server.pt/community/marine_data_%28obis-usa%29/791**).

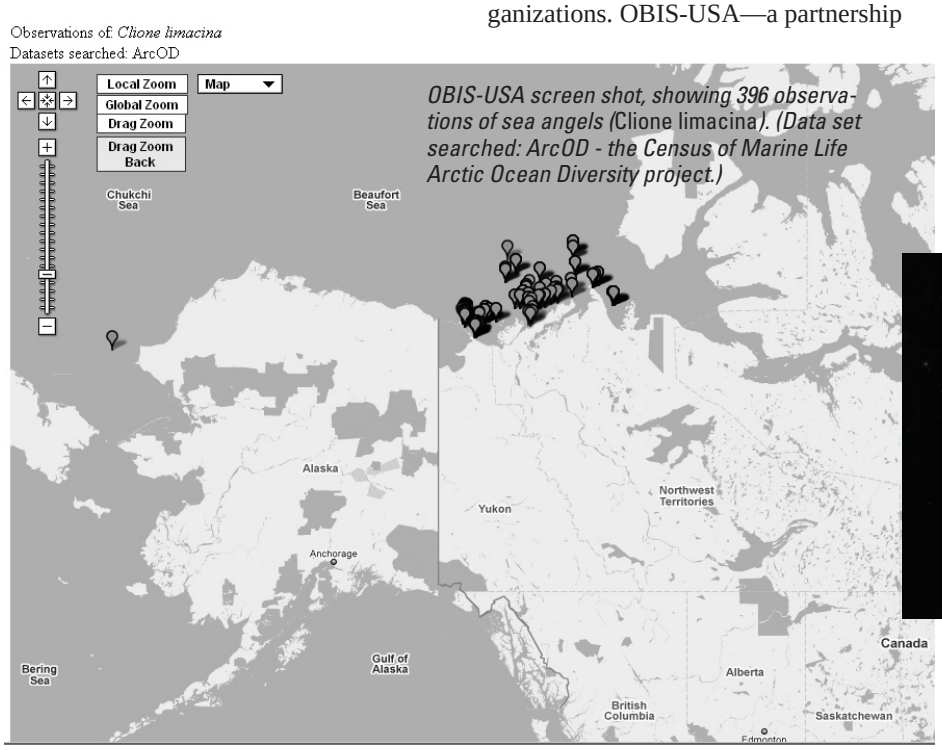
The OBIS-USA Web site offers a unique combination of tools, resources, and biodiversity information to aid scientists, resource managers, and decision makers in the research and analyses critical to sustaining the Nation's valued marine ecosystems.

The new and improved Web site (it replaces an earlier, demonstration version) brings together biogeographic data collected from U.S. waters and oceanic regions—the Arctic, Atlantic, and Pacific Oceans, the Caribbean Sea, the Gulf of Mexico, and the Great Lakes. It provides access to data sets from numerous partners documenting where and when species were observed or collected, and allows users to examine each data set to assess its applicability for various uses.

OBIS-USA was established in 2006 in cooperation with the U.S. National Committee for the Census of Marine Life (**http://www.coml.us/**), a committee composed of distinguished individuals from research institutions, industry, resource management, and nongovernmental organizations. OBIS-USA—a partnership of State, Federal, and scientific organizations—is the United States' contribution to the International Ocean Biogeographic Information System (**http://www.iobis.org/**), an effort led by the Census of Marine Life to provide open access to global biodiversity data.

"The world's ocean is critically important, not only because of how it influences the climate, but also because it provides the resources for commercial, recreational, cultural, scientific, conservation, and national-security activities," said **John Mosesso**, OBIS-USA co-lead and Program Manager for the U.S. Geological Survey (USGS) Biological Informatics Program (**http://biology.usgs.gov/bio/**). "At the same time, the ocean is being subjected to a variety of changes, including warming temperatures, increasing ocean acidity, invasion by nonnative species, overharvesting, and loss of habitat."

(OBIS-USA continued on page 10)



*OBIS-USA screen shot, showing 396 observations of sea angels (*Clione limacina*). (Data set searched: ArcOD - the Census of Marine Life Arctic Ocean Diversity project.)*

*Sea angel (*Clione limacina*), the most common shell-less pteropod of Arctic waters. Courtesy of the Census of Marine Life Arctic Ocean Diversity project, © **Kevin Raskoff**.*

(OBIS-USA continued from page 9)

OBIS-USA provides data and tools to address key questions and information needs related to scientific understanding of ecosystems, marine spatial planning, climate change, ocean acidification, invasive species, and management of the Nation's fisheries. Addressing ocean stressors requires access to a wide range of information on marine biodiversity, **Mosesso** noted.

OBIS-USA data holdings comprise millions of individual records supplied by marine data sponsors from across the Nation. The site provides a workspace for visitors to search and manipulate those data. Collaboration with data providers produces a compilation of data in a common format. Data are interoperable and can be viewed and applied consistently by researchers, decision makers, and resource managers.

Data and metadata describing when and where species were observed or collected are available through an atlas where users can review and select specific data sets. Individual or composite data sets (user-created selections from the entire holdings) may be viewed through several functions, including:

- data dashboard—provides a pictorial view of data attributes that lets users assess their utility;
- data richness—assesses how well the data are populated for selected elements;
- data quality—provides key data-collection information;
- duplication status—indicates whether a data set may contain duplicate records;
- general metadata—displays the Federal Geographic Data Committee data record;
- geographic coverage—displays data-collection sites spatially;
- participants—names OBIS-USA participants, with the option to connect back to the atlas, dashboard, and metadata functions; and
- taxonomic depth—shows, in table form, the levels of taxonomic hierarchy for each organism.

OBIS-USA goals this year include an increase to more than 10 million total data records and expanded functionality to address such needs as integration with nonbiological data and further capability regarding species distributions.

To learn more about OBIS-USA, to help grow its list of data, and (or) to explore partnerships, contact the NBII's **Mark Fornwall** (**mark_fornwall@usgs.gov**) or **John Mosesso** (**john_mosesso@usgs.gov**).

Coordinated by the USGS, the NBII (**http://www.nbii.gov/**) is a broad, collaborative program to provide increased access to data and information on the Nation's biological resources.

Special Issue of the *Journal of Coastal Research* Highlights Lidar Applications in Coastal Settings and Features USGS Coastal and Marine Geology Studies

By Matt Cimitile and Ann Tihansky

Special Issue 53 of the *Journal of Coastal Research*, released in November 2009, is dedicated to applications of airborne lidar (light detection and ranging) in coastal studies. U.S. Geological Survey (USGS) expertise is featured throughout the supplemental volume. **John C. Brock** (USGS, St. Petersburg, Florida) and **Samuel J. Purkis** (National Coral Reef Institute, Nova Southeastern University, Fort Lauderdale-Davie, Florida) were coeditors. Their overview, "The Emerging Role of Lidar Remote Sensing in Coastal Research and Resource Management," discusses the critical role of coastal-elevation measurements in scientific research and resource management.

The collection of articles explores the capabilities and emerging roles for lidar technology—the use of laser light for mapping coastal land and adjacent shallow seafloor—as researchers expand its potential. Not only do the articles highlight various coastal applications and settings, but they also illustrate important partnerships in which scientists are working with resource managers to further develop this emerging technology. Of the 10 papers, 4 were authored by USGS scientists in the Coastal and Marine Geology Program in St. Petersburg, Florida: **Dave Zawada**, **Hilary Stockdon**, **Kara Doran**, **Abby Sallenger**, **Monica Palaseanu-Lovejoy**, **Amar Nayegandhi**, and **Wayne Wright**. Other USGS authors include **Brock**, **Dean Gesch**, **Jason Stoker**, **Phil Turnipseed**, **K. Van Wilson**, and **Michael Oimoen**. Partners include the National Park Service (NPS); the National Oceanic and Atmospheric Administration (NOAA); the National Coral Reef Institute, Nova Southeastern University; and the University of the Virgin Islands. Examples of lidar applications include characterizing coral-reef topography in Florida, coastal vulnerability to extreme storms in New York, and vegetation types in coastal Louisiana.

Coral reefs are some of the most irregular substrates in the marine environment, with little known about the range of topographic complexity exhibited within reefs. **Zawada** and **Brock** used lidar-derived bathymetric data to quantify the topographic complexity, or roughness, of part of the northern Florida Keys reef tract. The technology helped them quantify the topographic complexity of a 25-km^2 area to 1-m spatial resolution.

The morphology and elevation of coastal sand dunes play an important role in determining how beaches will respond to hurricanes and extreme storms. **Stockdon**, **Doran**, and **Sallenger** measured dune-crest elevations by using lidar applications to map the vulnerability of Fire Island National Seashore in New York to inundation during hurricanes. By comparing lidar-derived dune elevations with modeled wave setup and storm-surge height for a category 3 hurricane, scientists were able to forecast that water levels would exceed dune elevations along 70 percent of the coastal park—information that is valuable for coastal managers.

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USGS spatial analyst **Palaseanu-Lovejoy**, computer scientist **Nayegandhi**, and physical scientist **Wright**, along with **Brock** and **Robert Woodsman** (NPS), shared their work evaluating lidar technology as a method for distinguishing the spatial distribution of vegetation types in Jean Lafitte National Historical Park and Preserve, Louisiana. Remote-sensing tools that can map and distinguish vegetation types have extensive applications for land-management practices.

To view the special issue's table of contents, including links to abstracts and articles, visit **http://www.bioone.org/toc/coas//53**.

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