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U.S. Department of Commerce
National Oceanic and Atmospheric Administration

Supporting Coastal Communities, Economies, and Ecosystems

David M. Kennedy, Acting Assistant Administrator for NOAA's Ocean Service

The Nation's coastal communities and economies depend on healthy coastal ecosystems, but these assets are threatened by expanding coastal populations and increasing societal use of coastal lands and waters. Inadequate, fragmented planning and management of multiple uses has degraded coastal habitats, increased coastal pollution, and enhanced vulnerability to natural hazards. Coastal communities and economies face risks from resource depletion and degradation, associated negative human health impacts, and use of lands, which may be at a higher risk to coastal hazards. At the same time increased demands for offshore energy, aquaculture, and marine transportation coupled with increased interest in area-based conservation have enhanced the need to sustainably manage finite coastal and ocean areas and competing uses. For instance while only 17 percent of the Nation's land area is coastal, it supports over 50 percent of the population and generates nearly 60 percent of the U.S. gross domestic product (Crossett 2004). Likewise coastal areas contain the Nation's most diverse, valuable, and at-risk habitats, which support 90 percent of ocean-dependent commercial and sport fish species; generate billions of recreation and tourism dollars annually; and protect coastal communities from storms, floods, and other hazards (Pendleton 2008).

Climate change is expected to amplify these challenges as habitat is lost to coastal inundation. The U.S. will expect increasingly intense storms and changes in sea-level; increased pollution from vulnerable shore-based facilities (e.g., oil production facilities and sewage treatment plants); an increase in harmful algal blooms, hypoxia, and pathogen events in response to warming waters, among other threats.



David M. Kennedy

Given the challenges facing the Nation's coasts NOAA must focus its science, capacity building, education, and management capabilities on the most urgent coastal problems. NOAA's extensive Congressional mandates and valuable skills provide a clear and specific role in meeting the public demand for related products and services. These mandates, in part, direct NOAA to: work with coastal states to develop and implement programs that manage land and water uses in coastal areas; protect and restore coastal habitats and living resources; designate and manage marine and estuarine protected areas; conduct research to understand the human and natural drivers of climate change as well as to estimate future climate change; and understand and provide forecasts to prevent harmful algal blooms and hypoxia.

The projects and activities shared in this issue of the *Earth System Monitor* offer a small sample of what NOAA is doing to help address the Nation's coastal challenges. You will read about such efforts as the development of a state-of-the-art system for measuring the earth's height that, in turn, allows for critically needed accuracy in measuring change in sea levels, as well as NOAA's support of coastal communities in evaluating the siting of renewable energy technologies in coastal and marine areas. These efforts help bring to life NOAA's coastal mission as one of the key priorities for the agency. ■

From the NODC Director



Margarita Conkright Gregg, Ph.D.

This issue of the *Earth System Monitor* focuses on a key priority for this Administration and NOAA: the health of our coasts and ecosystems, and what critical services NOAA provides to our nation.

As the scientific stewards for the nation's ocean and coastal data, NODC has the responsibility for preserving these unique and irreplaceable records. Through a diversity of products and services, our data describes the history of a changing environment and provides a baseline for assessing changes. These activities are carried out in partnerships across NOAA and the federal government as well as with our regional, state, and academic partners.

NODC provides services to the Gulf States during hurricane season

Each year, NODC produces waterproof NOAA Extreme Weather Information Sheets (NEWIS) for the Atlantic hurricane season. NEWIS provides coastal residents with a "one stop" ready reference, containing important contact phone numbers and Web sites for emergency information in the state and local area.

NODC provides services for recreation

The Coastal Water Temperature Guide (CWTG) is a popular site for scientists,

recreational users, and the media. The maps and tables of coastal near-real-time water temperatures and climatological averages provide useful information for planning multiple beach activities.

NODC partners to monitor the health of our coasts

NODC contributes to the Gulf of Mexico Hypoxia Watch, which develops products that form the basis for summertime advisories on anoxic and hypoxic conditions in the Gulf of Mexico. NODC is also a partner in the Harmful Algal Blooms Observing System (HAB-SOS) program, providing the integration of *in situ* observations, surface forecasts, and satellite imagery products into an Internet Management Service. In addition, NODC is active in the development of the infrastructure that supports ecosystem observations data collected as part of the Gulf of Mexico Alliance.

NODC preserves our sea level history

In partnership with the World Data Center for Oceanography, Silver Spring, and the University of Hawaii Sea Level Center, NODC maintains the Joint Archive for Sea Level. This collaborative project acquires, reviews, and assesses historical observations of the changes in sea level from the United States, as well as over 60 agencies in 70 countries.

As a new year approaches, NODC is defining its strategies for the future. Our focus is twofold: 1) to provide our community with the products and services needed as we are faced with the challenge of how to effectively utilize our coastal resources, and how to protect these resources from the impacts of climate change; and 2) to ensure we preserve the wealth of data that NOAA is invested in for both current and future generations. Your feedback on our products and services are critical to ensure we are serving the needs of the coastal and ocean communities. ■

EARTH SYSTEM MONITOR

The *Earth System Monitor* (ISSN 1068-2678) is published by the NOAA Satellite and Information Service. Past issues are available online and are syndicated by an RSS feed. See: www.nodc.noaa.gov/ESM

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SSMC3, 4th Floor
1315 East-West Highway
Silver Spring, MD 20910-3282

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An aerial photograph of a coastal town with a white aircraft flying overhead. The aircraft is a twin-engine turboprop plane, likely a Cessna 441, with the registration number N52RF visible on the tail. The town below has a mix of residential and commercial buildings, and the surrounding area is hilly and wooded.

Better Coastal Management with the Modernization of the Vertical Datum

Galen Scott, National Geodetic Survey; Edited by: Dru A. Smith, National Geodetic Survey, Michele Winowitch, Office of Ocean and Coastal Resource Management

In the early days of ocean voyages, knowing “How Far?” and “How Long?” were serious considerations that every sailor faced. Who wants to get lost at sea with scurvy? These days it’s not so much about distance or time; it’s about height or, in more technical terms, it’s about the vertical datum. A vertical datum is a surface of zero elevation, to which elevations are referred, so as to maintain consistency. So the question is: when you say “elevation,” just what is that elevation above? What is the “zero-point” that observing systems such as tide stations, water level gages, or topographic maps reference? In common usage, elevations are often cited as “height above sea level,” although what “sea level” actually means is a more complex issue than one may realize. The height of the sea surface at any one place and time is a result of numerous effects including waves, wind and currents, atmospheric pressure, tides, topography, and even differences in the strength of gravity due to the mass variations in the Earth (mountains, valleys of the crust, density differences in the mantle, etc.).

In fact, the word “height” has no singular meaning, though there are two definitions in common use today:

- **Orthometric Height (H):** The distance along the plumb line from the geoid to the point of interest. These are often the heights seen on topographic maps and generally will predict the direction of water flow.
- **Ellipsoid Height (h):** The distance along the ellipsoidal normal from some chosen ellipsoid to the point of interest. These are the heights that come out of the GPS system and are not good predictors of the direction of water flow.

Of course, we’ll need to define a few terms used above:

- **Ellipsoid:** A simple mathematical shape described by an equatorial radius and flattening index that approximates the shape of the Earth. (This shape is used to provide a grid for latitude and longitude coordinate systems and looks much like a slightly flattened basketball).
- **The Plumb Line:** A line that is everywhere tangent to the direction of the local gravity vector (yes, gravity doesn’t point “straight down,” but tilts a small amount based on mass variations).

- **The Geoid:** The surface of equal gravity potential energy that best fits to global mean sea level. This surface, while linked to sea level, is globally continuous and therefore extends through the continents.

Coastal communities that are planning and preparing for potential disasters in the coastal zone require a detailed understanding of the topography of the land; specifically where water will go in the event of flooding. In order to do this, the relationship between the orthometric heights (used in topographic maps) and the heights of local water levels at tide or water level monitoring stations (used in bathymetric maps and hydrographic surveys) must be known. But even this is only part of the picture. Understanding the coastal land-water interface depends on how these water levels change over time and must also account for the fact that the land moves vertically over time, but not always downward. For example, while the Gulf Coast is subsiding downward, portions of the Alaskan coast are actually uplifting. To combine or compare coastal elevations from diverse sources, they must be referenced to the same vertical datum in a common framework. Using inconsistent datums can cause artificial discontinuities between land and water interface that can become acutely problematic when producing maps at the level of accuracy that is critically needed by federal, state, and local authorities to make informed decisions. This is especially important when mapping the shoreline. NOAA is responsible for surveying 95,000 miles of the Nation’s coasts to provide an accurate, consistent, and up-to-date national shoreline.

One serious problem to overcome is that the most recent vertical datum, NAVD 88 (North American Vertical Datum of 1988), is becoming outdated. NAVD 88 was established as a “modern” replacement for the far less accurate, and far sparser network of benchmarks that made up the previous vertical datum (NGVD 29 – National Geodetic Vertical Datum of 1929). However, soon after NAVD 88 was complete, the Global Positioning System came along. The era of GPS brought fast, accurate ellipsoid heights and users have demanded that NAVD 88 be improved to give fast, accurate orthometric heights as well. To respond to this and thus create a more accurate, relevant vertical datum the NGS has begun a 10 year project to use gravity to redefine the best models of the geoid, and use it as the zero elevation surface in the vertical datum that will replace NAVD 88. With a new geoid model, GPS will be able to yield orthometric heights and not just ellipsoid heights.

Development of the new vertical datum will result from the completion of a new NOAA initiative, known as Gravity for the Redefinition of the American Vertical Datum

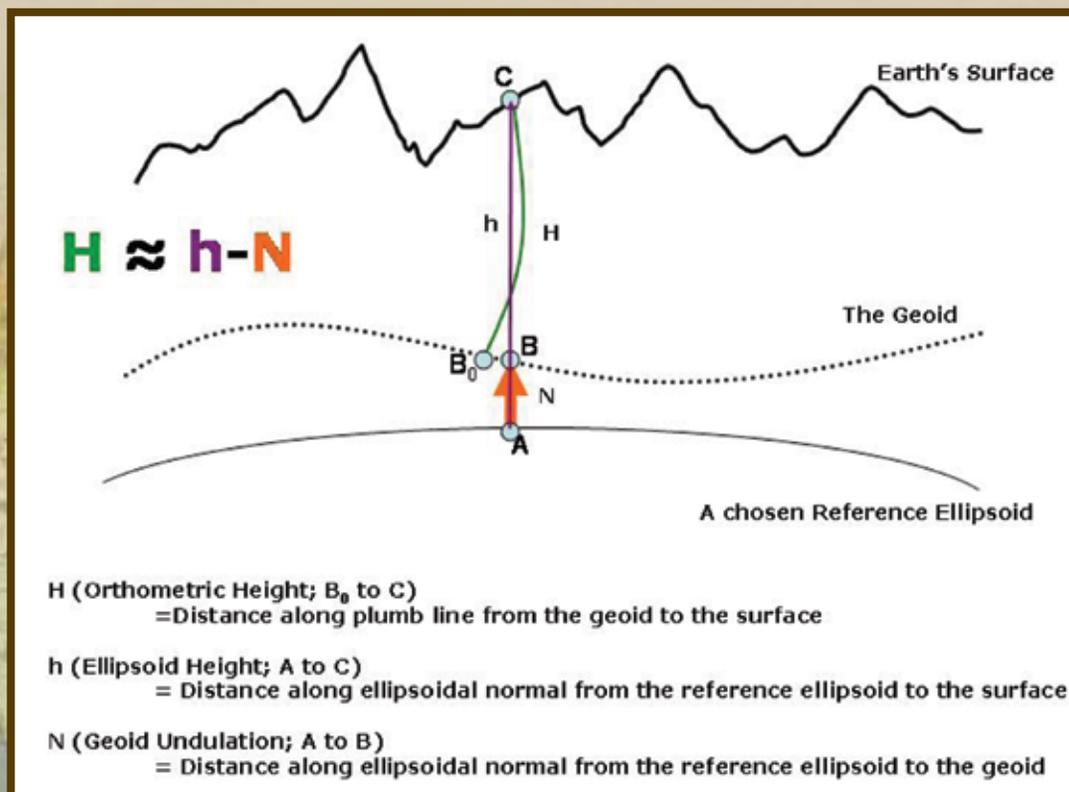
Gravity for the Redefinition of the American Vertical Datum (GRAV-D). This will allow surveyors and scientists to use the Global Positioning Systems (GPS) to determine more precise and accurate orthometric elevations than currently possible in less time and with less effort. This has profound implications for surveying and mapping efficiency and accuracy. A new geoid based on the GRAV-D project will increase accuracy of national elevations measured to the nearest 2 cm (approximate) compared to as much as a 2 meter difference today!

Using a highly sensitive airborne absolute gravity meter and kinematic GPS on aircraft and a suite of absolute and relative gravity meters on the surface of the earth, NGS is collecting the data that will be used to create the new vertical datum for the United States. With a goal of obtaining a high-resolution, instantaneous (geologically speaking), consistent view of the entire near-surface terrestrial gravity field for the U.S. and its territories, NGS began with an initial pilot project in the Alabama Gulf Coast. This will continue with the highest priority targets: Alaska (August 2009), Puerto Rico and the Virgin Islands (January 2009), the Gulf Coast (May 2009), the Great Lakes, and the coastal regions of the United States. The Pacific island states and

territories will follow, with the interior of the continental United States next.

In order to begin connecting the water level datums to terrestrial datums, NOAA has developed a revolutionary vertical datum transformation tool called VDatum. VDatum translates geospatial data between 36 different vertical reference systems and removes the most serious impediments to data sharing, allowing for the easy transformation of elevation data from one vertical datum to another. VDatum will also improve the efficiency and accuracy of hydrographic surveys for nautical charts by eliminating the need for time-consuming benchmark comparisons, water level corrections, and post processing. NGS provides the sea surface topography grids and all of the algorithms for the datum conversions and transformations as well as the geoid model required to convert NAD 83 and NAVD 88 values. CO-OPS operates the National Water Level Observing Network (NWLON), maintains the tidal benchmark network, and derives local tidal datums. OCS produces the grids used to interpolate between tidal datums based on hydrodynamic modeling. ■

All of these pieces are combined into regionally based executable models available at vdatum.noaa.gov



The relationship between orthometric heights, ellipsoid heights, and the Geoid.

Managing Our Invaluable Coastal Ecosystems in the Face of Rising Sea Levels

Carol Auer, NOAA Center for Sponsored Coastal Ocean Research

The storm surge from Hurricanes Opal (1995), Katrina (2005), and Ike (2008) clearly demonstrate the potential for coastal ecosystems to incur massive losses from flood inundation. As sea level rises, coastal storms will be stronger and able to cause more damage. In the face of the twin threats of sea-level rise and increasing coastal storm ferocity, resource managers and land use planners must ensure survival of critical ecosystems that support fisheries and tourism. According to Jesse Feyen, NOAA's storm surge team leader, current storm surge products do not provide the high quality information in a manner that our stakeholders understand.

“Coastal residents and businesses are asking, ‘How much water? Where will it go? When will it arrive, and how fast? What will be the impact for my house or my business?’” said Feyen. “Using state-of-the-art science and technology, we need to communicate street level impacts that result in appropriate personal and community response before, during, and after the events.”

NOAA's National Centers for Coastal Ocean Science (NCCOS) Ecological Effects of Sea Level Rise program—developed by the Center for Sponsored Coastal Ocean Research—set out to help biologists, sociologists, economists, and land use planners make more informed decisions about their coastal communities in the face of sea-level rise. Since Fall 2005, NOAA partnered with North Carolina coastal managers and Carolina universities to create ecological models that will integrate with a NOAA physical model, developing useful decision-making tools. These tools will be used in natural resource protection, land use decisions, water quality, fisheries, and transportation.

The North Carolina estuarine system was chosen as a pilot location because it is the third largest estuary in the country at more than two million acres. In addition, it supports a diverse ecosystem and is of prime economic importance to the coastal area—90 percent of the commercial seafood species caught in the state spend at least part of their lives in an estuary. There is also the established North Carolina Coastal Reserve and National Estuarine Research Reserve System, which is a network of 10 protected sites established for long-term research, education, and stewardship. Lastly, in 2008 an updated, accurate shoreline was completed and readily available for the entire coastline. The pilot effort, referred to as the North Carolina



A scientist installs a Surface Elevation Table, or SET, a portable, mechanical leveling device deployed atop a fixed vertical bench mark to measure changes in surface elevation relative to the depth of the bench mark.

Sea Level Rise Project, includes the study area of Neuse River and the Southern Pamlico, Back, Core, and Bogue Sounds.

Several ecological models were developed to forecast the impacts of sea-level rise on various coastal habitats and physical locations. Two examples of these models and some recent on-the-ground results are:

- Forecasting the Ecological Effects of Sea-Level Rise on Coastal North Carolina Marshes:** Forecasts the effects of rising sea level on the condition of intertidal marshes inside Pamlico Sound, North Carolina. One important goal of the research was to determine through combined modeling and field studies if present day marshes are currently keeping pace with sea level. Major field experiments include measurements of the change in surface elevation within these marsh communities and bioassay experiments using *Juncus roemerianus* and *Spartina alterniflora* (dominant plant species of Pamlico Sound).
Results: The vegetated wetland is stable only when the marsh platform is able to accrete sediment at a rate comparable to the prevailing rate of sea-level rise. This ability to accrete is proportional to the biomass density of plants, concentration of suspended sediment, time of submergence, and the depth of the marsh surface and the tidal range. The rate of global averaged sea-level rise is accelerating, suggesting potential loss of salt marsh habitat in the next few decades.
- Quantifying and Evaluating the Effects of Rising Sea Level in North Carolina:** Conducted in the Neuse River Estuary and the Pamlico Sound, this study evaluated the rate of sea-level rise over the last several centuries and the ensuing shoreline and shorezone change from 1958 to 1998. It also evaluated the ecological ef-

Photo Credit: NC Sea Grant, Riggs & Ames



On the western Pungo River, the eroding platform marsh (foreground) is undercut, while the receding low sediment bank (background) leaves a trail of dead pines in the encroaching water.

fects of sea-level rise. (Shorezone is the area of wetland that extends from an estuarine shoreline landward to where the hydrologic influence of sea level diminishes and terrestrial hydrology dominates.)

Results: With a mean shoreline-change rate of -0.58 m/yr, the majority (93%) of the Neuse River Estuary study area is indeed eroding. General trends were determined at a local scale and analysis determined higher erosion rates, higher elevation, and lower exposure and fetch in the up-estuary.

The results from these and other NOAA models in the study area are allowing coastal managers and planners to build effective conservation plans. One example of this is

in the Albemarle-Pamlico Peninsula, where the effects of erosion are already visible: shoreline erosion is increasing; the region's peat soils are degrading quickly; and natural communities are in hasty retreat from saltwater intrusion. As much as one million acres on the Peninsula may be lost to encroaching seas over the next one hundred years. The Nature Conservancy and U.S. Fish and Wildlife Service are implementing a comprehensive set of strategies to abate the effects of climate change on this rich complex of coastal ecosystems. To ensure the sustainability of complex natural communities they are using land conservation, habitat restoration, and a variety of science-based adaptation techniques. Ecological models are also an essential component of this project to ensure the success of on-the-ground restoration. These models will help to identify priority erosion zones, predicted vegetation change, and effects of hydrologic restoration.

This summer scientists and managers convened at a workshop to facilitate the communication and integration of the results from the North Carolina Sea Level Rise Project to interested managers. The maps and tools provided by this project are in the final stages of development and will be displayed on the planned NOAA Climate Portal.

NCCOS is encouraged by the success of the Ecological Effects of Sea Level Rise project in North Carolina. Similar projects will begin in the Gulf of Mexico and California in 2010 and 2012. In October 2009, a NOAA white paper, "North Carolina Sea Level Rise Project: Application to Management," was published to discuss their findings. ■

For more information on this paper, download it at: www.cop.noaa.gov/stressors/climatechange/current/slr/AppMgmt_workshopNCSLR.pdf

Finding the Coastal Perspective on the NOAA Climate Services Portal

NOAA has taken a coordinated approach to making available critical information on the impacts of climate change to multiple audiences, including the coastal management community. Coming soon is the **NOAA Climate Services Portal**, which will be a central access point to NOAA resources such as data and services, tools, trainings, web sites, articles, and other resources that address climate change in the coastal zone. One resource the portal will provide access to will be the Coastal Climate Adaptation Web site, where managers can find out what their colleagues are doing to adapt to climate change, learn about existing adaptation guides and plans, access tools for adaptation planning, and research the impacts of climate change that their communities may be facing. Content will be continuously updated to provide the newest information and the freshest ideas on addressing impacts of climate change from a wide breadth of offices that support coastal and ocean management including the Coastal Services Center, Sea Grant, and Office of Ocean and Coastal Resource Management. Additional resources are in the works from the National Weather Service, National Centers for Coastal and Ocean Science, Office of Habitat Conservation, and National Marine Sanctuaries. For more information contact: Lindy.Betzhold@noaa.gov (Coastal Services Center).

NOAA Supports Communities in Exploring Wind Energy Options in Coastal Areas

Amy Painter, Communications Manager, National Sea Grant College Program

Renewable coastal and ocean energy development technologies hold great promise for our Nation. However, at a time when the United States faces pressure to develop renewable sources of energy, little is known about the impact of wind, wave, and other potential energy-generating technologies on coastal communities. NOAA is working at local, state, and regional levels to provide vital, science-based information and decision-support tools that will help residents and community leaders make informed decisions about renewable energy options. NOAA's National Sea Grant College Program is supporting a variety of renewable energy efforts, including several projects in the Great Lakes region.

For example, Michigan's coastal zones possess abundant wind resources. However, poorly sited wind farms may interfere with other uses of the coast such as recreation, commercial fishing, and nature preservation. Some communities are not prepared to manage these conflicting priorities.

NOAA's National Sea Grant College Program is working on two pilot integrated assessment projects in Michigan. One project is exploring the potential conflicts with locating wind power facilities in the West Michigan coastal areas of Muskegon, Ottawa, and Allegan counties. Researchers are working with stakeholders, including government representatives, environmental advocates, business groups, and concerned citizens, to examine the issues surrounding wind farms. These issues include environmental (wildlife impacts, pollution reduction), social (citizen involvement in decision making), economic (benefits to communities, impacts on tourism), aesthetic (visibility of turbines), and policy (existing local and county regulations). The research team will assess these issues through case studies, focus group workshops, and geographical analysis using Geographic Information Systems (GIS). The project will result in the development of a conflict map, which indicates the most sensitive areas for building wind farms in an effort to help communities avoid the most important and sensitive areas. The conflict map will be used to assess the likelihood of environmental, social, and economic conflict in the project area. The expected outcomes will provide:

- Opportunities for stakeholders to consider siting of

wind technologies in advance of any development proposals from industry.

- An assessment of the benefits and challenges for the siting of wind turbines at different locations.
- Strategies to avoid and/or resolve potential conflicts.
- Identification of towns that lack strong regulations.
- GIS and visualization tools to help site facilities and minimize negative impacts.

The second project focuses on helping community leaders in some of the windiest regions of Michigan understand the possible benefits and consequences of wind energy development. Three distinct coastal regions of Michigan were selected for the study: Presque Isle County, Bay County, and the Keweenaw-Houghton-Baraga-Marquette area. In each region a series of public meetings, focus groups, and interviews will be conducted to gather feedback about local concerns. Using input from local people and a variety of data sources and models, researchers will assess several factors related to wind energy development: environmental and aesthetic impacts; costs and benefits for communities; interests and motivations of different stakeholders; information and support needed by communities; existing local ordinances and inconsistencies between local and state policies; and, technical considerations, including turbine design and transmission needs. The expected outcomes for this project are to develop optimum approaches for evaluating and locating wind energy facilities in the three coastal regions. The project will build expertise among Michigan residents, decision makers, and other wind energy stakeholders by providing or enhancing:

- Information about the full costs and benefits of wind energy development.
- Training opportunities for government officials and community groups.
- Access to decision-support tools for turbine siting, such as the GIS-based Wind Prospecting Tool.
- Sample local ordinance and state statutory language for regulating coastal resources.
- Recognition of local concerns within state-level policy discussions. ■

For more information or to get involved with these efforts, visit www.seagrant.noaa.gov/other/admininfo/sg_ocean_and_coastal_renewable_energy_activities_8_06_09.pdf

Putting Tools and Information in the Hands of Decision Makers

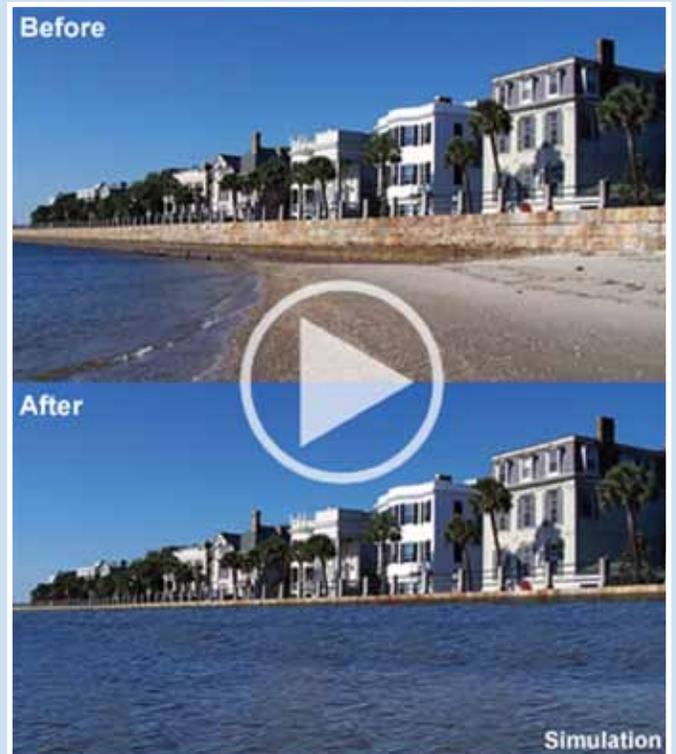
Lindy Betzhold and Hanna Goss, NOAA Coastal Services Center

To face various challenges to our coastal areas, including rising sea levels and other impacts of climate change, coastal professionals are leading the effort to enhance the resilience of our tens of thousands of coastal communities. Resilient communities adapt and maintain an acceptable level of functionality and structure in the face of social, cultural, environmental, and economical adversity. Creating resilient coastal communities requires all levels of government and society to work together to learn from the past and from each other to reduce risks, plan and prepare for a better future, and be ready to respond and rebound if the worst does happen. In order to address these issues effectively coastal professionals need access to the right tools, information, and resources to make decisions. NOAA's Coastal Services Center (CSC) is using the Internet to put tools, information, and resources into the hands of coastal decision makers.

One resource is the NOAA CSC's Digital Coast Web site, a community-driven enabling platform and partnership effort. The Digital Coast Web site provides an integrated suite of data, decision support tools, training, and real-world case studies to the coastal resource management community. Launched in 2008, this Web site provides information to address timely coastal issues including land use, coastal conservation, hazards, and marine spatial planning, all of which must consider long-term changes in climate to be successful. One of the goals behind its creation was to help unify groups that might not otherwise work together. This partnership network is a strong collaboration of coastal professionals intent on addressing coastal resource management needs. While phase one of the Digital Coast Web site focused on content provided by CSC, subsequent phases are adding information from this network of NOAA partners, as well as from other Federal organizations, state and local governments, and private and nonprofit sectors.

A new feature available on the Digital Coast Web site is the Coastal Inundation Toolkit, which helps communities determine vulnerabilities to flooding and ways to reduce risk. Using this toolkit, coastal professionals can educate themselves about inundation; learn to identify and map potential impacts of inundation; assess a community's risk and vulnerability; and find information about communicating risk to residents while motivating communities to take action. In addition, the toolkit provides information on how

existing communities are addressing their inundation risks, such as impacts from sea-level rise. For example, the County Snapshot—a downloadable coastal resource—provides a quick look at a county's demographics, infrastructure, and environment within the flood zone, as well as a detailed guidebook on mapping inundation.



Another component of the toolkit is CanVis. This downloadable program can be used to create visualizations of potential impacts from coastal development or sea-level rise. Users can download background pictures and insert objects, such as hotels, houses, or marinas, of their choosing. The software is used by municipalities to brainstorm new ideas and policies, undertake project planning, and make presentations.

The list of issues that coastal professionals face every day is lengthy and difficult. By providing managers with the data, tools, training, and information they need to make decisions, the NOAA CSC is helping to ensure that our Nation's coastal communities are resilient, no matter what kind of challenges are being faced. ■

To see the Digital Coast Web site, visit www.csc.noaa.gov/digitalcoast, and to access the Coastal Inundation Toolkit, visit www.csc.noaa.gov/inundation

NEWS BRIEFS

Coral Bill Closer to Reauthorization

The House of Representatives recently passed the Coral Reef Conservation Act Reauthorization and Enhancement Amendments of 2009, known as H.R.860. This bill would bolster U.S. coral reef conservation efforts by promoting international cooperation to protect coral reefs, codifying the U.S. Coral Reef Task Force, and, among other changes, providing authority for emergency response actions to coral reef injury events throughout the U.S. Exclusive Economic Zone.

This passage is the latest progress in the effort to reauthorize the Coral Reef Conservation Act of 2000 (CRCA). Representatives Bordallo (D-Guam), Baird (D-WA), and Ros-Lehtinen (R-FL) spoke on behalf of the bill, expressing strong support and a dire need to protect coral reefs. H.R. 860 received support of a bipartisan group of 19 Members of Congress, and was endorsed by the Administration; the Governors of Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands; and marine conservation interests.

The CRCA provides NOAA with powerful tools to study, manage and protect coral reef ecosystems. The initial act expired in 2004. Efforts to reauthorize the CRCA during the past several sessions of Congress have proved unsuccessful, though headway was made during the 110th Congress. With passage in the House, we are awaiting introduction in the Senate which is imminent.

For more information,
Contact: Shannon.Simpson@noaa.gov,
NOAA Coral Reef Conservation Program, 301.713.3155 x145

Management Strategies Considered for Offshore Renewable Energy Development

The development of readily available sources of renewable energy is being hindered by uncertainties about the impacts of its development in the marine environment. A broad range of federal agencies, industry representatives, and other stakeholders gathered in Washington, DC in September 2009, to discuss management strategies for resolving these uncertainties.

The two day workshop, co-sponsored by the Coastal States Organization and the National Ocean Service's Office of Ocean and Coastal Resource Management, identified the prerequisites for successful adaptive management strategies and needed improvements in the federal approach to reviewing renewable energy projects. The findings of the workshop may provide helpful insights to the on-going NOAA Strategic Energy Review and Ocean Policy Task Force discussions.

As a result of the recent upswing in interest in installing Ocean Thermal Energy Conversion (OTEC) facilities, the Office of Coastal Resource Management and the Coastal Response Research Center at the University of New Hampshire co-sponsored a three day OTEC Technology Workshop in Durham, New Hampshire in November 2009. OTEC technology uses the temperature differential between the deep cold and warmer surface waters of the ocean to generate electricity. The workshop will address state-of-the-art technology, technical feasibility, and the time frame for commercial-scale development of an OTEC system. More than 50 participants including federal representatives from NOAA, the U.S. Department of En-

ergy, the Naval Facilities Engineering Command, national laboratories, academia, OTEC developers, and other experts attended. It will also help NOAA make better informed decisions regarding OTEC licensing applications, for which the agency has responsibility under the Ocean Thermal Energy Conversion Act.

For more information,
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Office of Ocean and Coastal Resource Management, 301-563-1151

Smart Growth for Coastal & Waterfront Communities

On September 9, 2009, NOAA, the U.S. Environmental Protection Agency, the International City/County Management Association, and Rhode Island Sea Grant released "Smart Growth for Coastal and Waterfront Communities." Developed in consultation with the national Smart Growth Network, the inter-agency guide builds on the network's ten smart growth principles to create coastal and waterfront-specific strategies for development.

The guide includes an overview of the unique development challenges and opportunities along the water and provides specific approaches to development that include a description of the issues, tools and techniques, and case studies. "Smart Growth for Coastal and Waterfront Communities" is intended for planners, local government officials, developers, residents, and other stakeholders.

To learn more, download full report at:
<http://coastalsmartgrowth.noaa.gov>

NOAA Funds 50 Recovery Act Coastal Restoration Projects

Rachel S. Brittin, NOAA Fisheries Office of Habitat Conservation

This past summer, Commerce Secretary Gary Locke and NOAA Administrator Dr. Jane Lubchenco announced 50 new habitat restoration projects that will restore damaged wetlands, shellfish beds, and coral reefs. NOAA is funding the restoration projects with \$167 million it received under the American Recovery and Reinvestment Act of 2009. These projects will also reopen fish passages that boost the health and resiliency of our Nation's coastal and Great Lakes communities.

By August 2009, NOAA had started work on 13 projects, with approximately 30 active in December. When complete, the projects will have restored more than 8,700 acres of habitat and removed obsolete and unsafe dams that open more than 700 stream miles where fish migrate and spawn. The projects will also remove more than 850 metric tons of debris, rebuild oyster and other shellfish habitat, and protect 11,750 acres to reduce threats to coral reefs.

Healthy coastal habitats are critical to the recovery and sustainability of the U.S. economy. Coastal areas generate more than 28 million jobs in the United States. Commer-

cial and recreational fishing employs 1.5 million people and contributes 111 billion dollars to the Nation's economy. A significant number of these coastal and Great Lakes restoration projects are in areas such as California, Oregon, and Michigan, that have some of the highest unemployment rates. The projects will employ design engineers, restoration ecologists, landscape architects, and other Americans with a range of skills. In addition to direct jobs, the projects are estimated to support indirect jobs in industries that supply materials and administrative, clerical, and managerial services.

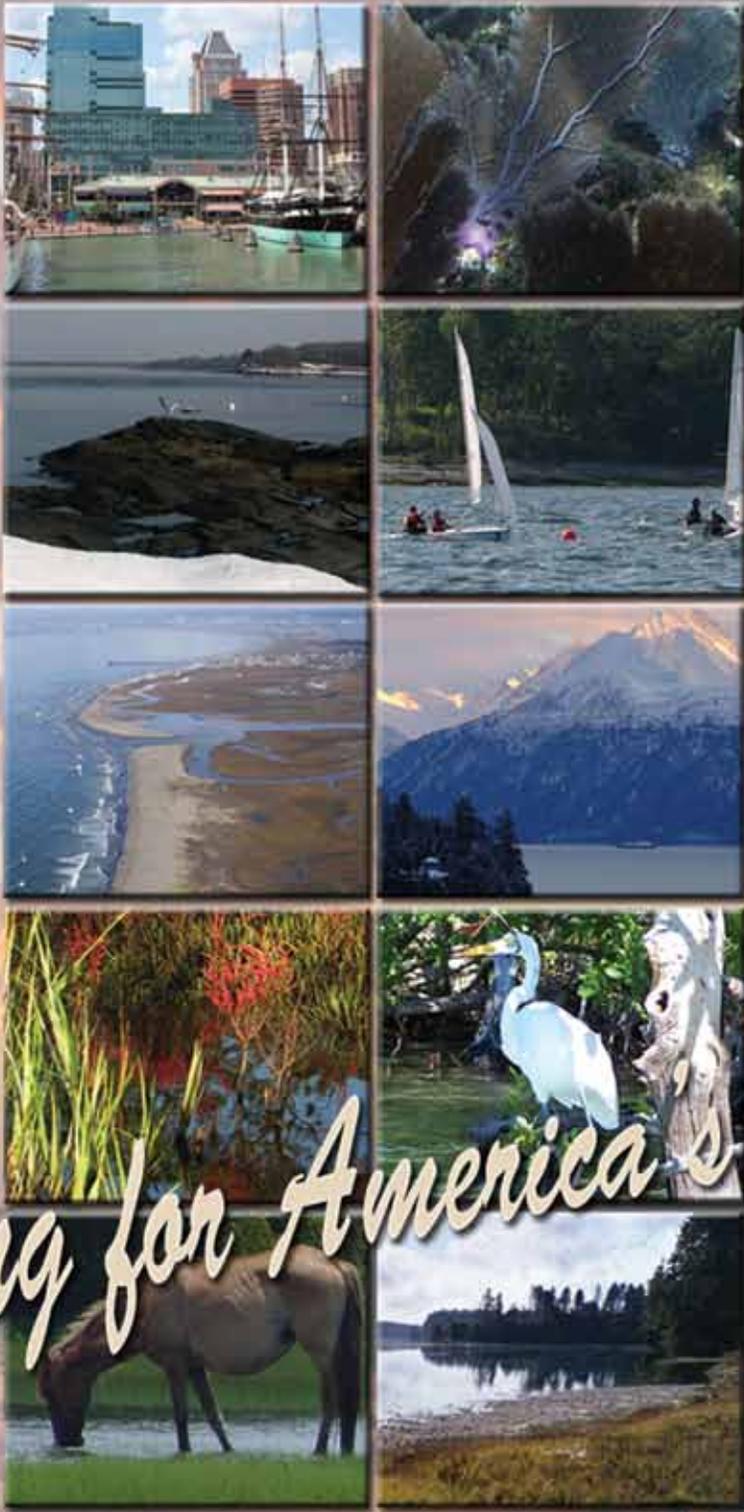
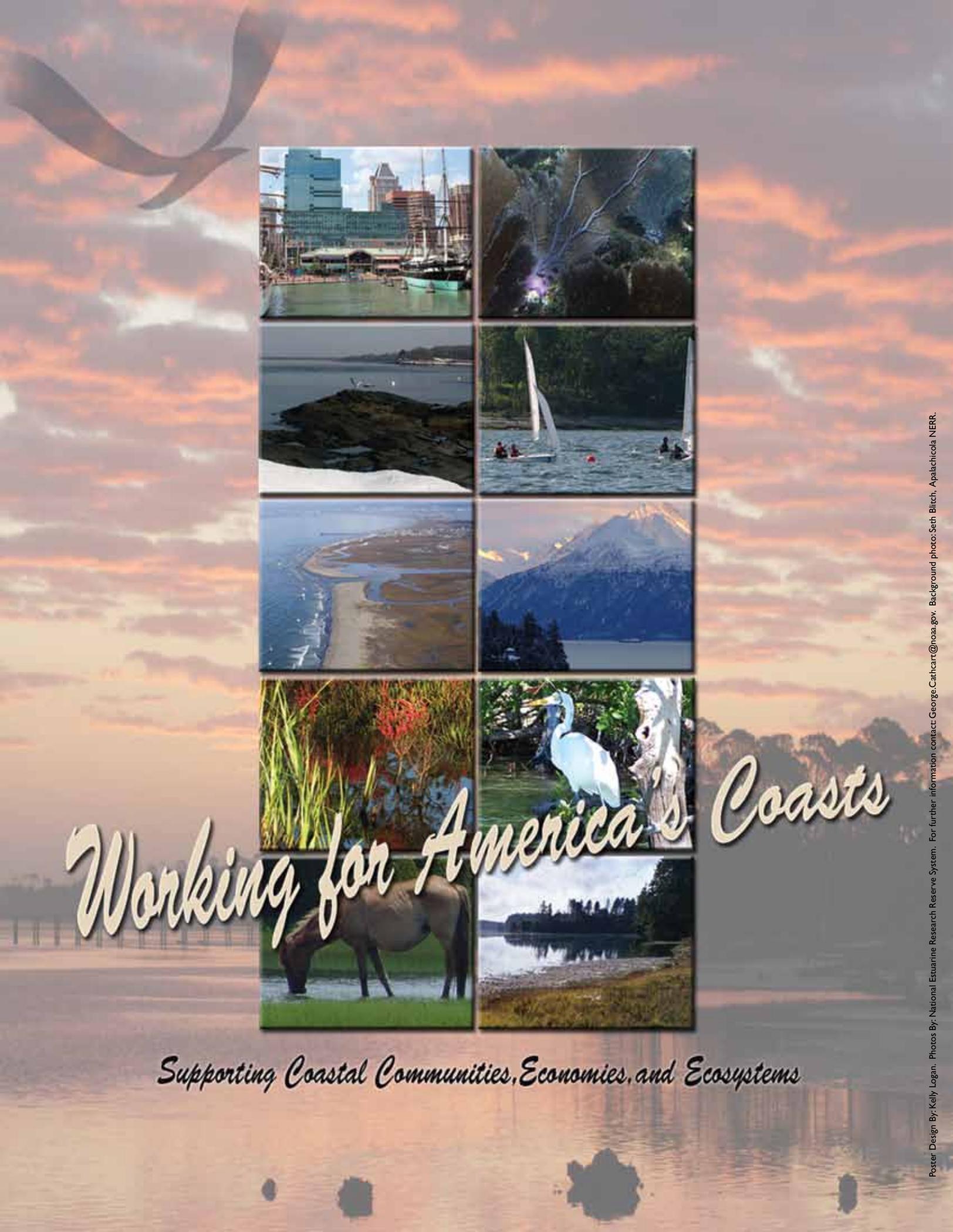
"NOAA is investing in green jobs for Americans to restore habitat for valuable fish and wildlife and strengthen coastal communities, making them more resilient to storms, sea-level rise, and other effects of climate change," Lubchenco said. "In addition to the immediate jobs created by the projects, stronger and healthier coastal communities will boost our Nation's long-term economic health."

The projects were chosen from a pool of more than 800 proposals totaling 3.2 billion dollars in requests. NOAA worked through a rigorous selection process to identify and prioritize projects meeting the Recovery Act's criteria. ■

For further more information on funded projects nationwide, visit go to www.noaa.gov/recovery



Photo Credit: NOAA/CSC



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Library Features Historic Treasures and Current Resources in “Discovering Darwin” Exhibit

Kathy Kelly, Marine Protected Areas Librarian, NOAA Central Library

The NOAA Central Library is highlighting the work of Charles Darwin in a new exhibit called “Year of Darwin 2009: Discovering Darwin at NOAA Central Library” in honor of the 150th anniversary of Darwin’s publication *On the Origin of Species* and the 200th anniversary of his birth. The library’s staff created the exhibit as part of the “Year of Darwin” celebration that includes participation from museums, government agencies, academic institutions, and scientific publishers worldwide.

The “Year of Darwin 2009” exhibit features both historic and current NOAA resources in a variety of formats such as books by and about Darwin and the development of evolutionary theory, with materials on Darwin’s role in the historic 1831-1836 surveying voyage on the HMS Beagle, and resources dealing with the biodiversity of and protective measures for the Galapagos Islands. An early edition of Darwin’s *The Structure and Distribution of Coral Reefs* is featured, which introduced his theory of the formation of coral reefs and atolls. Several key books are supplemented with short overviews or book reviews.

The exhibit also highlights illustrations of Darwin’s finches (from “Zoology of the Beagle”), Galapagos-related images from the NOAA Photo Library, Darwin resources on the Web, and evolution cartoons. The final item is an October issue of the journal *Science*, which features a theme section on the latest evolutionary discovery about the earliest hominids along with access information on the many journals on ecology and evolutionary biology that NOAA libraries provide in hard copy and/or online to the NOAA community. ■

A related bibliography, “Discovering Darwin at NOAA Central Library: Resources on Charles Darwin, Evolution, and the Galapagos Islands” is available at www.lib.noaa.gov/researchtools/subjectguides/darwinbib.pdf