NEWSWAVE

NEWS FROM THE U.S. DEPARTMENT OF THE INTERIOR: OCEANS, COASTS AND GREAT LAKES

Special Feature: Landscape Conservation Cooperatives p. 13

Spring 2015

Dive In – Explore Coastal and Seafloor Images On-line

By Nadine Golden, Seth Ackerman and Jessica Robertson, USGS

Thousands of photos and videos of the seafloor and coastline are available and easily accessible online through the USGS Coastal and Marine Geology Video and Photograph Portal. The portal is unique due to the sheer quantity and quality of data presented. It is the largest database of its kind, providing detailed and fine-scale representations of the coast. The "geospatial context" is also unique, with maps displaying imagery in the exact location where it was recorded. Imagery like this supports planning in coastal and marine areas and understanding of habitat change, impacts and vulnerabilities. *(see related stories this issue*)

How does it work? Start with the tutorial and then dive in!
http://cmgvideo.usgsportals.net/

One of many photographs available through the USGS Coastal and Marine Geology Video and Photograph Portal. Photo credit: USGS

The U.S. Fish and Wildlife Service's Coastal Program works to remove barriers to fish passage such as the Octoraro Creek Dam Removal project in Cecil County, Maryland. Photo credit: USFWS

Studies Show Rivers Resilient After Dam Removal

More than 1,000 dams have been removed across the United States because of safety concerns, sediment buildup, inefficiency or having otherwise outlived usefulness. A paper published in *Science* finds that rivers are resilient and respond relatively quickly after a dam is removed.

"The apparent success of dam removal as a means of river restoration is reflected in the increasing number of dams coming down, more than 1,000 in the last 40 years," said Jim O'Connor USGS geologist and lead author of the study. "Rivers quickly erode sediment accumulated in former reservoirs and redistribute it downstream, commonly returning the river to conditions similar to those prior to impoundment."

See Dams page 4

Managing Resources at the Landscape Scale

This issue of ***NEWSWAVE*** includes a special feature (*page 13*) on coastal Landscape Conservation Cooperatives (LCCs) that highlights examples of applied science to help manage resources and human activity across large and interconnected landscapes.

See EBM page 2

Coastal Reconstruction at New Jersey's Long Beach Island

On May 7, construction began to complete the remaining sections of the Storm Damage Reduction Project on Long Beach Island, New Jersey. The project is part of President Obama's continuing commitment to help coastal communities recover from Hurricane Sandy and promote resilient coastal systems.

See Beaches page 4

In this Edition:

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EBM continued from page 1

Another article discusses Ecosystem-Based Management (EBM), is a foundational principle of the National Ocean Policy. This is a dynamic, adaptive, and iterative process that changes based on the spatial scale and location of the project and the mission and goals of the agency and program. The EBM approach relies on collaborative partnerships and planning as well as scientific data, tools, and mapping products. Many articles within this issue are examples of, and resources that support the EBM approach. *(See related article page 3)* EBM strategies strive for a common goal, framed within a set of core elements:

- Adaptive and flexible, responsive to monitoring and research results;
- Place-based with geographic areas defined by ecological criteria;
- Cross-sectoral, considering interactions between sectors of human activity;
- Proactive, incorporating tradeoffs to manage the marine and coastal environments; and
- Inclusive and collaborative, encourages participation from all levels of government, indigenous peoples, and stakeholders.

This issue includes artwork by contributing comic artist Cole Goco. *See related story on page 8.*

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Federal Efforts in Ecosystem-Based Management (EBM)

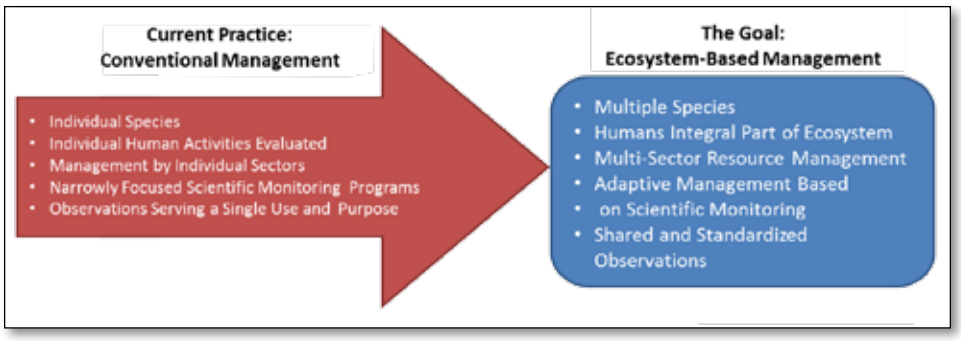
By Adam Fullerton, Frank Schwing and Margaret (Peg) Brady, NOAA

The current and future environmental challenges facing ocean, coastal, and Great Lakes ecosystems can be addressed with EBM principles by using a broad management approach that considers cumulative impacts on marine environments. This approach works across sectors to manage species and habitats, economic activities, conflicting uses, and the sustainability of resources. EBM considers resource tradeoffs that help protect and sustain diverse and productive ecosystems and the services they provide.

The National Ocean Policy identifies EBM as a foundational principle of ocean and coastal resource management. To advance the goals of the National Ocean Policy, an interagency team used a questionnaire tool to analyze how EBM is used currently in the Federal Government.

More than 60 federal programs and projects from 13 agencies responded to the questionnaire, sharing information on program components ranging from trainings and partnerships to the use of EBM principles and best practices. While far from comprehensive, the results show that there are many paths to EBM, with no specific approach being better than others.

The survey results also identified numerous training tools, including many that may be adaptable for other federal programs. These tools included both online and in-person classes and manuals. Expanding collaborations and knowledge sharing within and between agencies will be essential to advancing, expanding and improving EBM use.



Ecosystem-based management (EBM) is an integrated management approach that recognizes the full array of interactions within an ecosystem, including humans, rather than considering single issues, species, or ecosystem services in isolation. Image credit: NOAA

The results also highlight that programs with the primary goal of managing natural resources integrated a higher level of EBM approaches than programs focused on science and research or programs that managed non-natural resource projects in ocean and coastal areas. Effective advancement of EBM strategies relies on scientists, managers, conservationists, and policymakers bringing together their diverse knowledge and expertise.

This analysis shows that there is broad use of EBM by federal programs in the marine environment; but there is also room for improvement. Enhancing collaborations between science and management programs and across different agencies will help move us towards the holistic marine resource management practices needed to support healthy ocean, coastal, and Great Lakes ecosystems, and to sustain the myriad economic, societal, and environmental services they provide.

Corals in the Capital!

News from the U.S. Coral Reef Task Force

By Cheryl Fossani, DOI

Amidst a February snowstorm, the U.S. Coral Reef Task Force (USCRTF) convened its 33rd meeting in Washington, D.C. This meeting brought together experts in science and in policy to discuss diverse issues threatening the health of the nation's coral reefs. USCRTF Co-Chairs Lori Faeth, DOI's Deputy Assistant Secretary for Policy and International Affairs, and Eileen Sobeck, Assistant Administrator for NOAA's National Marine Fisheries Service, provided remarks along with Governor Calvo, the Governor from Guam.

This three-day meeting was jam packed with numerous working group meetings, presentations, and public events. The USCRTF Education and Outreach Working Group hosted a public Science Café where Dr. Mark Eakin, the coordinator of NOAA's Coral Reef Watch Program, led a discussion about the diversity and biology of coral reefs, the threats that coral reefs face, and how scientists and natural resource managers are trying to alleviate the impacts and promote conservation of these fragile ecosystems.

See Corals page 27

Aerial photo of the Elwha River mouth and expansion of the river mouth delta by sediment deposition as a result of removing upstream dams. Photo credit: Neal and Linda Chism of LightHawk

Beaches continued from page 1

Sand dredged from federal offshore waters is being placed along 11.5 miles of shoreline between Barnegat Inlet and Little Egg Inlet in the previously unconstructed portions of the project.

"Hurricane Sandy left a mark on coastal communities up and down the east coast," said BOEM Director Abigail Ross Hopper. "With the sand resources now identified, this agreement reflects BOEM's continuing commitment to work with New Jersey to help coastal communities recover from Hurricane Sandy and enhance resilience efforts for the future," Hopper said. "We are committed to working in a collaborative manner to help local communities withstand damage from future storms."

This is the largest amount of OCS sand conveyed by BOEM along the Atlantic coast for a single project to date. The beachfill construction is designed to reduce storm damages to property and infrastructure that is vulnerable to the impacts of hurricanes, nor'easters, and long term erosion. *http://www.boem.gov/press05072015/*

Dams continued from page 1

Dam removal and the resulting river ecosystem restoration is being studied by scientists as part of a national effort to document the effects of removing dams. Studies show that most river channels stabilize within months or years, not decades, particularly when dams are removed rapidly.

"In many cases, fish and other biological aspects of river ecosystems also respond quickly to dam removal," said Jeff Duda USGS scientist and co-author of the study. "When given the chance, salmon and other migratory fish will move upstream and utilize newly opened habitat."

The increase in the number of dam removals, both nationally and internationally, has spurred the effort to understand the consequences and help guide future dam removals.

"As existing dams age and outlive usefulness, dam removal is becoming more common, particularly where it can benefit riverine ecosystems," said Gordon Grant, Forest Service hydrologist. "But it can be a complicated decision with significant economic and ecologic consequences. Better understanding of outcomes enables better decisions about which dams might be good candidates for removal and what the river might look like as a result."

http://www.usgs.gov/newsroom/article.asp?ID=4207#.VUvWCxrF_UY

Conowingo Dam Exceeding 90 Percent Capacity For Sediment

The Conowingo Dam on the Susquehanna River is at about 92 percent capacity for sediment storage according to a new USGS report. *Sediment Transport and Capacity Change in Three Reservoirs, Lower Susquehanna River Basin, Pennsylvania and Maryland, 1900–2012.*

Since the dam's construction in 1929, sediment and nutrients have been building up behind it, being released periodically downriver and into the Chesapeake Bay, especially during high flow events.

"Storage capacity in Conowingo Reservoir continues to decrease, and ultimately that means more nutrients and sediment will flow into the Bay," says Mike Langland, a USGS scientist and author of the study. The Susquehanna River is the largest tributary to Chesapeake Bay, transporting about half of the Bay's total freshwater input, along with substantial amounts of sediment, nitrogen and phosphorus.

"Understanding the sediments and nutrients flowing into the Bay from the Susquehanna River is critical to monitoring and managing the health of the Bay," said Langland.

U.S. EPA's Chesapeake Bay Program and state partners will use this information to meet the Chesapeake Bay Total Maximum Daily Load requirements. The report is available online. *http://www.usgs.gov/newsroom/article.asp?ID=4129&from=rss#.VUvdfBrF_UY*

Data Categories for Marine Planning

By Fran Lightsom, USGS

The National Ocean Policy of 2010 called for regional planning bodies (RPBs) to coordinate a wide range of ocean and coastal activities using an ecosystem-based management approach to improve our ocean, coastal and Great Lakes resources *(See related story page 1)*. Of the nine national coastal regions, five already have established RPBs which include federal agencies, states, tribes and first nations, as they bring together stakeholders to identify and address regional concerns. Each of the regional areas is managing a large marine ecosystem, with its own unique combination of habitats, human uses, challenges and risks. Planning at this level depends on a broad and transparent foundation of reliable data.

Data Supply Chain:

The data supply chain for marine planning is a distributed, interconnected network of independent people, organizations, and machines.

Data producers make and interpret measurements, process and integrate data, and contribute their products to data repositories.

Agency Data Specialists sort through agency data holdings, select appropriate data sets, update their metadata, and submit the metadata to the federal repository for data holdings: *Data.gov*

Data System Managers work with a federal committee that sorts through Data.gov, selects appropriate metadata, and organizes it into a National Ocean Planning Data System. A Regional GIS Expert produces a Regional Data System,

www.data.gov/ocean

which can then be used more easily by the Regional Planning Body.

The challenge is to coordinate and organize the distributed network of independent data suppliers to produce consistent data foundations needed for regional marine planning.

USGS and partners in EPA and NOAA, developed a controlled vocabulary that defines the essential data; provided a logical structure for organizing data catalogs; and placed it online to enable automated use and future updates to the categories.They recently published a set of data categories for marine planning that can build consistency in how we select, label, and organize data systems and search interfaces.

The list of categories can be used in sorting and selecting the data that is needed for marine planning. The controlled vocabulary adds value when the terms are also used to identify data, so that automated systems can use them to sort and search.

Together, we are moving forward to meet the challenge of producing the data foundations for regional marine planning. This will make it easier for regional data portals to locate the data they need, especially if the regional data providers are also using the controlled vocabulary to identify datasets useful for marine planning.

USGS report: "*Data Categories for Marine Planning*" *http://dx.doi.org/10.3133/ofr20151046*

USGS Information for Marine Planners and Resource Managers *http://marine.usgs.gov/marineresourceinfo/*

Conservation Leadership in the Coral Triangle

By Leilani Gallardo, DOI-International Technical Assistance Program

Three recent events highlight where Interior is participating to improve marine conservation within the Coral Triangle.

Local governments and women leadership have convened to address specific issues and establish organizational structures to promote marine resource conservation, sustainable fisheries management and support climate change adaption strategies in their constituencies.

In Papua New Guinea (PNG), women leaders from coastal communities committed to work together, share experiences, inspire each other, and find ways to strengthen their capacity in leading marine and coastal resource conservation projects during the first ever gathering of women engaged in marine conservation and sustainable fisheries. The event, entitled the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security Women Leaders' Forum

See Coral Triangle page 6

Coastal communities rely on a wide range of data to manage multiple uses and healthy resources both on land and in the water. Photo credit: USGS

In July 2014, the USFWS with NOAA, designated terrestrial critical habitat areas include 88 nesting beaches in coastal counties located in North Carolina, South Carolina, Georgia, Florida, Alabama and Mississippi. These beaches account for 48 percent of an estimated 1,531 miles of coastal beach shoreline used by loggerheads, and about 84 percent of the documented numbers of nests, within these six states. Photo credit: USFWS

Sand to Restore Sea Turtle Nesting Habitats, Reduce Coastal Vulnerability

The Bureau of Ocean Energy Management (BOEM) and Florida's Collier County signed an agreement for the use of up to 500,000 cubic yards of sand from the Outer Continental Shelf to restore and protect the coast.

"Under this agreement, BOEM is continuing its commitment to work with Florida's coastal communities to enhance resilience efforts for the future," said BOEM Director Abigail Ross Hopper. "We are committed to continuing our collaborative efforts to help local communities withstand damage from future storms and address the effects of climate change, such as rising sea levels, which challenge coastal areas."

The sand will assist Collier County Parks and Recreation Department's efforts to restore nesting beach habitat for loggerhead sea turtles and will renourish four segments of shoreline totaling 7.5 miles, near Naples, Florida. This will reduce coastal storm flooding and erosion and provide recretional and environmental habitat benefits. The project will raise eroded beach berm elevations to those consistent with natural berm elevation and increase the distance between the beach and coastal development. This action will also restore and maintain habitat for threatened and endangered sea turtle and shorebird species. *http://www.boem.gov/Marine-Minerals-Program/*

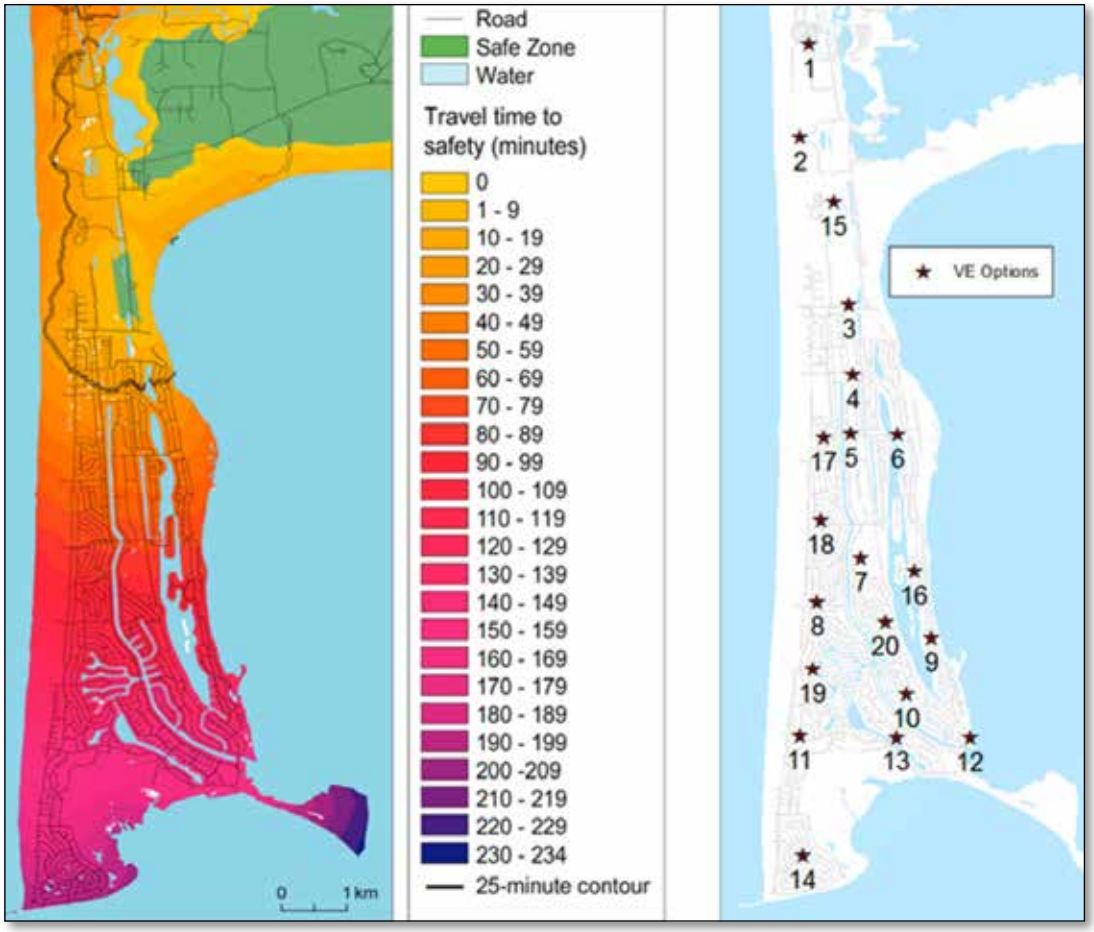
Coral Triangle continued from page 5

(CTI WLF) Roundtable, was held in Alotau, Milne Bay on March 24, 2015. Forum participants elected a national coordinator and provincial focal points and designated the PNG Center for Locally Managed Marine Areas as their interim secretariat. Through these efforts, they aim to reach out to other women leaders and share training opportunities to strengthen their skills in managing their marine and coastal resources.

In Malaysia, the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF) and the Women Leaders Forum held the Earth Hour Awareness Talk in Kudat, Sabah, Malaysia on March 28, 2015. The talk highlighted women's conservation leadership in case studies featuring four women from grassroots organizations who are championing conservation in the proposed Tun Mustapha Park in Sabah. This globally significant priority conservation area is threatened by overfishing, destructive fishing and pollution. Over 40 women, including university students attended the talk. The Women Leaders Forum is designed to be a dynamic peer-learning network to build the capacity of women as environmental custodians.

Local government leaders from the Coral Triangle Initiative member countries and their partner organizations gathered in Alotau, Milne Bay, PNG on March 25-27, 2015. They elected a set of officers led by the Regent of Wakatobi, Indonesia, adopted an organizational structure, and defined the roles of the network's Regional Secretariat, which will be hosted by the League of Municipalities of the Philippines in Manila. The local government leaders also agreed to engage women to take part in CTI-CFF decision-making processes and programs and empower women to lead and implement coastal and marine programs in their communities. The CTI Maritime Local Government Network is a group of local government executives from coastal and maritime localities in the six Coral Triangle member countries - Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands and Timor-Leste. Network members promote marine resource conservation, sustainable fisheries management and support climate change adaption strategies in their constituencies.

http://www.coraltriangleinitiative.org/news



Maps of Ocean Shores, Washington, a city on the state's Pacific coast.

At left, estimated pedestrian travel time at a slow walking speed (in minutes) to evacuate predicted tsunami-hazard zones associated with a Cascadia subduction zone earthquake. (The tsunami waves are estimated to arrive approximately 25 minutes after being triggered by the earthquake.)

At right, possible locations for vertical evacuation structures proposed at a community meeting.

Image credit: USGS

http://www.usgs.gov/blogs/features/usgs_top_story/preparing-communities-for-the-next-great-tsunami/

TSUNAMI!

Can you walk to safety in time?

By Jeanne Jones, Nathan Wood and Leslie Gordon, USGS

Scientists at the USGS have developed a new mapping tool, the Pedestrian Evacuation Analyst for use by researchers and emergency managers to estimate how long it would take for someone to travel on foot out of a tsunami-hazard zone. The ArcGIS software extension, released in September 2014, allows the user to create maps showing travel times out of hazard zones and to determine the number of people that may or may not have enough time to evacuate. The maps take into account the elevation changes and the different types of land cover that a person would encounter along the way.

Maps of travel time can be used by emergency managers and community planners to identify where to focus evacuation training and tsunami education. The tool can also be used to examine the potential benefits of vertical-evacuation structures, which are buildings or berms designed to provide a local high ground in low-lying areas of the hazard zone. The Pedestrian Evacuation Analyst software can assist communities with tsunami planning by answering such questions as:

How long could it take for people to evacuate out of tsunami-hazard zones? Will people have enough time to evacuate before the first tsunami waves arrive?

If people don't have enough time to evacuate, then where could vertical-evacuation refuges provide high ground? How do you compare the benefits of multiple sites for potential vertical-evacuation refuges?

"The tool can be used to provide valuable decision support for tsunami evacuation planning and vertical-evacuation siting, which is just in the beginning stages in the U.S. Pacific Northwest," said Jeanne Jones, USGS geographer who led the development of the software tool. The tool has enabled USGS researchers to better understand various aspects of community vulnerability to tsunamis, including community comparisons based on evacuation times, vertical-evacuation decision support, the impact of post-tsunami recovery decisions, and the evacuation challenges posed by different types of tsunami threats.

The software and user's guide: *http://geography.wr.usgs.gov/science/vulnerability/tools.html*

Drawing from the Sea

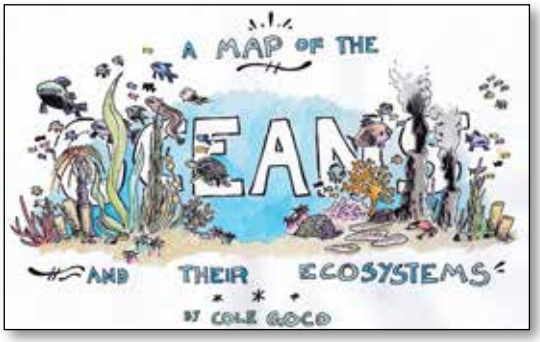
By Ann Tihansky, DOI

"Oceans are one of my favorite things to draw," said artist and comic strip author Cole Goco. "Because of the diversity, there is just so much to draw; cool fish, sea turtles, sea slugs," said Goco. He has created his own illustrative style and at 13 years old, he is a very committed artist.

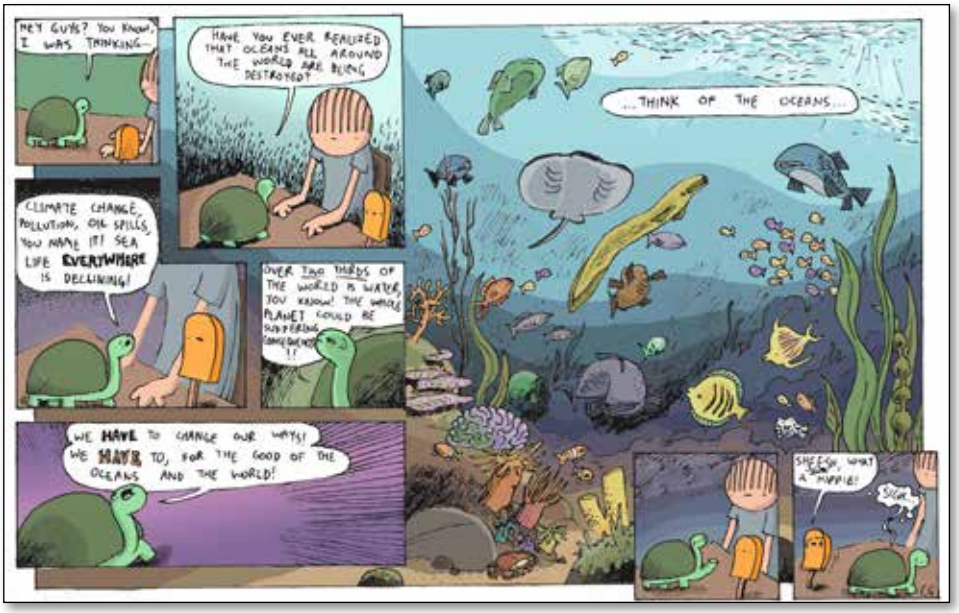
Cole produces a comic strip called 'Billy the Pop,' about an orange popsicle named Billy who observes, contemplates, plays pranks, and grumbles a bit. Billy's friends; Harley the human and Pete the turtle, offer their perspectives in a humorous exchange. Goco covers a wide range of topics using this format. While the ocean isn't an everyday theme for 'Billy the Pop,' we are pleased to share a few ocean-themed examples here.

Cole is inspired by what goes on around him. He says that conversations or events at school, family vacations, even his younger siblings can spark his creative process. Goco is a dedicated student and member of the comic arts community. In March 2015, he was an exhibitor at the Smudge Expo Comic Convention in Washington, D.C. He takes classes, he's won awards, he creates logos, wrapping paper designs and custom T-shirts.

The strip runs every other day and Cole budgets his weekend time to make sure he has created comics for the following week. He keeps up the production pace while balancing his time with school and family and friends but he's the first to admit he'd rather be writing and illustrating comics. "It's fun. When I'm not drawing them, I'm reading them, " said Goco.



At left- Cole Goco stands in front of a map of ocean ecosystems he created for a school project.
At right- The cartouche he created for the map.
Cole created 'Billy the Pop,' a comic about an orange popsicle named Billy and his friends; Harley the human and Pete the turtle.
Below are two ocean-themed comics that ran earlier this year.
Find more of 'Billy the Pop' here: *http://billythepop.blogspot.com/*
Look for more artwork by Cole in this issue. Image credits: Cole Goco.



From Injury to Recreation:

Public Use Benefits from Interior's Natural Resource Damage Assessment Restoration Program

By Samantha Spiece, DOI and Jill Webster, USFWS

On November 7, 2007 the M/V *Cosco Busan* struck one of the towers of the San Francisco-Oakland Bay Bridge, that spilled 53,000 gallons of bunker fuel oil into the water. The spill killed nearly 7,000 birds and oiled over 100 miles of shoreline which included nesting and feeding habitat and sensitive eel grass beds. The oil also impacted the Golden Gate National Recreation Area, Point Reyes National Seashore, and the San Francisco Maritime National Historic Park.

When natural resources are injured through the release of oil or hazardous substances, the impact to the public through the loss of use of the land or natural resource is considered in the proceeding damage assessment. These losses consist of impairments in public use and enjoyment of natural resources. Therefore, many projects completed with Natural Resource Damage Assessment and Restoration funds offer various recreational benefits to the community.

Over 45 recreational use projects were identified to receive settlement funds from the 2007 Cosco Busan Oil Spill. In 2014, several projects were completed. These projects created recreational improvements in areas around San Francisco Bay. Muir Beach has a new picnic area, a new pedestrian bridge and boardwalk to the beach, new trails, new vault toilets, and a new parking lot. Coyote Point Promenade has a new pathway and three new launching ramps. Rodeo Beach can now be accessed by a new, robust stairway built to withstand coastal weather and tidal action.

At right- A new parking lot and footbridge will improve visitor access at Muir Beach Dunes while increasing protection of sensitive dunes habitat. Photo: Shirwin Smith, NPS

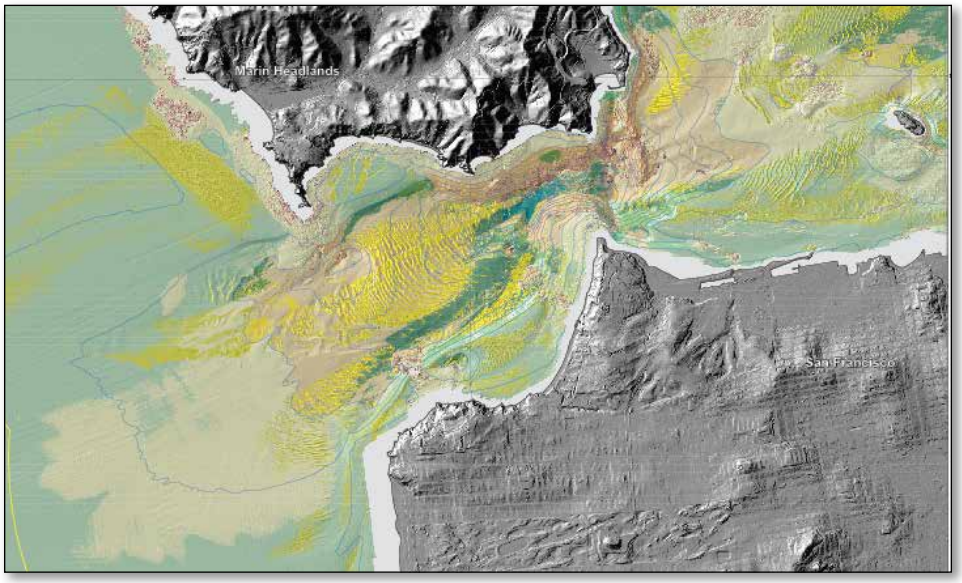
The National Park Service has begun work on the O'Shaughnessy Seawall at Golden Gate National Recreation Area, also using funds from the Cosco Busan settlement. When completed, the seawall will provide easier public access to the esplanade and an improved shoreline.

Above- The O'Shaughnessy Seawall in the 1970's looking south. The original design featured curved walls with bleachers that broke incoming surf and provided recreational access. Photo credit: NPS

New Maps of Seafloor off San Francisco

Below is a "Seafloor character" map of the San Francisco Region. This is a type of habitat map that classifies the seafloor based on surface hardness and roughness. These maps can be used to assess ecosystems and habitat types for delineation or monitoring and protection. Critical for resource managers, the maps are part of the California Seafloor and Coastal Mapping Program.

http://www.usgs.gov/newsroom/article.asp?ID=4233#.VWSJ9vlViko



Coastal Blue Carbon

USFWS and USGS Team-up Science with Conservation

By Chris Darnell, USFWS

The Fish and Wildlife Service (USFWS) Coastal Program and the U.S. Geological Survey (USGS) Land Carbon Program are collaborating on a study of biological carbon sequestration in coastal wetland ecosystems, commonly known as "blue carbon."

What is "blue carbon?" It refers to the ability of coastal areas-- including tidal wetlands, sea grasses and mangroves--to sequester and store carbon dioxide and other greenhouse gases from the atmosphere, helping to mitigate the effects of climate change.

The emphasis of the research is on better understanding the impact of land management and upstream land use on the storage capability and long-term fate of carbon in different types of coastal wetlands, as well as identifying opportunities to use management strategies to increase carbon sequestration.

"A key goal is to make increasing carbon sequestration a management objective in habitat protection and restoration planning," according to Dr. Zhiliang Zhu, Deputy Program Coordinator of the USGS Climate and Land Use Change Program. It also supports both the President's 2014 Priority Agenda for Enhancing Climate Resilience and the USFWS 2010 climate change strategic plan, "Rising to the Urgent Challenge: Strategic Plan for Responding to Accelerating Climate Change."

Related studies are being conducted in coastal wetlands across the nation. USGS is collecting carbon flux data at the Pocosin Lakes and Great Dismal Swamp National Wildlife Refuges in the southeast, and at Nisqually National Wildlife Refuge in southern Puget Sound. At the Great Dismal Swamp NWR, the USGS is conducting a pilot study to look at ecosystem services provided by carbon sequestration, while at Nisqually NWR scientists are modeling the sustainability of restored and reference marshes and analyzing historical vegetation changes under projected sea-level rise scenarios.

Mangrove ecosystems are particularly effective at sequestering atmospheric carbon and providing coastal resilience. Photo credit: USFWS

Because mangrove ecosystems are particularly effective at sequestering atmospheric carbon and providing coastal resilience, the agencies are expanding their collaboration to map mangroves at J.N. "Ding" Darling National Wildlife Refuge in south Florida using remote sensing techniques to identify biological stressors that cause sudden mangrove die-offs.

An interagency Mangrove Workgroup including USFWS and USGS staff, and other mangrove experts from South Florida has formed to support these collaborative efforts.

This pilot study at Ding Darling has the potential to lead to other mangrove mapping and conservation projects in other subtropical and tropical coastal areas. The island of Pohnpei in the Federated States of Micronesia (FSM) is one site that is currently being considered. USGS and USFWS have begun working with The Nature Conservancy and the Micronesia Conservation Trust to develop a plan to map shoreline changes and mangrove distribution in order to produce a sea-level rise risk assessment and to quantify upland forest carbon stocks on the island.

This project will inform a feasibility assessment for marketing carbon credits for protecting and restoring mangrove forests throughout the Federated States of Micronesia.

Illustration credit: Cole Goco

Shorebird Science? iPlover is the App for That

By Rob Thieler, Hannah Hamilton, Ann Tihansky, USGS and David Eisenhauer, USFWS

Listed as threatened along the Atlantic coast, the piping plover is a small shorebird that depends on open coastal beaches to breed and raise its young. Photo credit: Jim Fenton

A new tool designed to help manage the threatened piping plover is only a download away. iPlover is the first smartphone data collection application developed by the USGS.

Coastal beaches are dynamic systems and managing them for beach-dependent species like the piping plover requires collecting data on physical and biological characteristics that will be affected by sea-level rise. Given the extensive Atlantic breeding range of the piping plover – spanning from North Carolina to Newfoundland – biologists have a lot of ground to cover.

iPlover supports a long-established network of partners working to address ongoing impacts on plover populations, such as habitat gain or loss due to storms, and will help manage plover populations. iPlover coordinates and synchronizes data collection so it can be more easily used to develop models that address long-term management concerns for habitat availability.

The data come in from all of our study sites basically in real-time," said Rob Thieler, USGS scientist and lead developer of the app. "It's already formatted, so data can be quickly plugged into our research models. This should really shorten the time between collecting the data, doing the science, and turning it into actionable information for management."

"iPlover is a great example of the USGS' ability to build and deliver a variety of science applications that use modern technology," said Nate Booth, USGS Chief of Office of Water Information and former Lead Architect for the USGS Center for Integrated Data Analytics. "It offers research teams great gains in data collection efficiency so that more time can be spent on analyzing the data rather than managing it."

"The USGS worked with diverse project partners to incorporate specific data collection needs and enable important stakeholders and partners to contribute data from hundreds of field observations within the plover's U.S. Atlantic coastal breeding range," said Andrew Milliken, coordinator of the North Atlantic Landscape Conservation Cooperative. "This included getting inputs from the U.S. Fish and Wildlife Service, National Park Service, state agencies and non-governmental organizations."

"The app highlights the synergies and benefits of interagency and interdisciplinary science that advances conservation," Milliken added.

http://www.usgs.gov/newsroom/article.asp?ID=4208#.VU0fVxrF-IU

NPS Park ranger teaches St. Croix sixth graders about the history and culture of Salt River Bay. Photo credit: NPS

Project Promise St. Croix

By Ernice Gilbert, The Virgin Islands Consortium

Project Promise, an organization that exists to help improve the lives of at-risk youth on St. Croix by providing empowerment initiatives, cultural programs, and family services, recently announced a partnership with the National Park Service (NPS) to produce Salt River's 2015 'Ticket to Ride' program. The 'Ticket to Ride' program offers sixth grade students in St. Croix's public school system the opportunity to visit and learn about the Salt River Bay National Historical Park and Ecological Preserve.

"This joint effort is in response to the Secretary of the Interior Sally Jewell's call to invest in the next generation of National Park Stewards," NPS Education and Interpretation Chief David Goldstein said.

'Ticket to Ride' is the first program of its kind offered by Project Promise, and organizers are anticipating that over 500 students will participate by the project's completion.

Learn more about project Promise: *http://www.projectpromisevi.com/* and NPS activities in the U.S. Virgin Islands: *http://www.nps.gov/viis/index.htm*

What Do You Know About Bowhead Whales?

A new animated film, "Arctic Currents: A Year in the Life of the Bowhead Whale," explores the epic journey of the bowhead whales as they make their annual migration across the Bering, Chukchi and Beaufort Seas.

At left and above-These images are from the animated film, "Arctic Currents: A Year in the Life of the Bowhead Whale." The 24-minute film lets you see and hear Bowhead whales in their native Arctic habitat. Image credits: BOEM
You can watch the film here: *http://www.boem.gov/Life-of-Bowhead-Whale/*
Read the blog: *https://arcticcurrents.wordpress.com/about/*
Learn more about bowhead whale ecological research: *http://www.north-slope.org/departments/wildlife-management/studies-and-research-projects/bowhead-whales/bowhead-whale-ecological-studies*

The film highlights bowhead whale taxonomy, physiology, and special adaptations to living in the Arctic. Learn about the baleen diet and associated behaviors as the whales travel widely throughout Subarctic and Arctic waters following their major food supply, krill. The film draws upon an extensive body of traditional knowledge gathered and sustained by the indigenous whaling peoples.

Through a joint effort between the University of Alaska Museum of the North, BOEM, and others, these partners hope to improve public understanding of the iconic bowhead whales and their role in the Pacific Arctic marine ecosystem, and inform public policy on managing offshore energy resources. Watch the film on-line at: *http://www.boem.gov/Life-of-Bowhead-Whale/* The video is also available in Inupiaq and Yupik languages.

Coastal Barrier Resources System Map Updates

On May 4, the USFWS announced the availability of final revised maps for all John H. Chafee Coastal Barrier Resources System (CBRS) units in Maine, Maryland, New Jersey, Virginia, 13 units in North Carolina, and one unit in New York. The updated maps were produced through a digital conversion project in partnership with the Federal Emergency Management Agency. In April 2014, the Service completed digitally converted maps for all CBRS units in Texas, Delaware, South Carolina, and one unit in Florida.

Digitally converted maps for the entire system are scheduled to be completed by the end of 2016. The revised maps do not correct mapping errors affecting private property owners; such changes require a separate review effort and must be adopted by Congress through legislation.

The CBRS was established in 1982 and is comprised of 856 geographic units that encompass approximately 3.2 million acres of relatively undeveloped coastal barrier lands located along the Atlantic, Gulf of Mexico and Great Lakes coasts, as well as Puerto Rico and the U.S. Virgin Islands. Most new federal expenditures and financial assistance that encourage development are prohibited within the system, including federal flood insurance. However, development still can occur within the system, provided private developers or other non-federal parties bear the full cost, rather than the American taxpayers.

The revised maps and additional information about the Coastal Barrier Resources System: *www.fws.gov/cbra.*

Keep up with BOEM science!
Subscribe here: *www.boem.gov/Science-Notes/*

SPECIAL FEATURE: Science for Landscape-Scale Management

Partners Tackle Coastal Challenges Together

By Elsa Haubold (USFWS), Whitney Peterson (PICCC), Gwen White (ETPBR), and Doug Burn (ABSI).

Secretary Jewell focused on Interior's landscape-scale approach to conservation and resource management in her first Secretarial Order in 2013, including a "coordinated Department-wide strategy to increase scientific understanding and development of effective adaptive management tools to address the impacts of climate change on our natural and cultural resources." *http://www.doi.gov/news/upload/secretarial-order-mitigation.pdf*

Global and national conservation challenges like development pressure, resource extraction, pollution, hypoxia, invasive species, and other impacts to our land, water, and wildlife are magnified by a rapidly changing climate. These challenges demand innovative approaches to resource management and conservation. In September 2009, then-Secretary Salazar recognized that many of Interior's essential functions were being impacted by climate change and that the scope of these impacts extended beyond the borders of federal lands. He established the Landscape Conservation Cooperatives (LCCs) to coordinate efforts so that managers had the information, rigorous science, and decision-making tools needed to plan for and implement adaptation strategies.

The LCC Network is designed to support these key strategies by establishing a forum to identify shared goals with a host of influential partners to leverage capacity in a sustained effort over the long-term and increase the likelihood of on-the-ground success.

LANDSCAPE CONSERVATION COOPERATIVES

A network of 22 LCCs and more than 280 partners nationwide

http://lccnetwork.org

"Our coastal and terrestrial natural areas face increasing pressure to meet the demands of a growing, more urban human population. These challenges are greater than any one organization can meet alone. The LCCs bring together multiple experts and resources to implement this new approach in resource management."

Elsa Haubold, National LCC Coordinator

LCCs are self-directed partnerships between federal agencies, states, tribes, non-governmental organizations, universities, and other entities that define science needs and jointly address challenges such as climate change in defined geographic areas. This approach coordinates the needs of multiple stakeholders as they address broad-scale conservation and natural resource issues.

The LCC network provides a forum where entities with statutory authorities and responsibilities and land management interests can come together to consider a larger landscape perspective and collectively find conservation solutions. A diverse consortia of federal, tribal, state agencies, non-governmental organizations, and other partners are engaged in LCC activities and provide financial, staffing, and other supportive resources.

Fourteen of the LCCs span coastal areas with others connecting to the coast through watersheds. Three examples show how these innovative partnerships are working to achieve the LCC vision in coastal and marine environments:

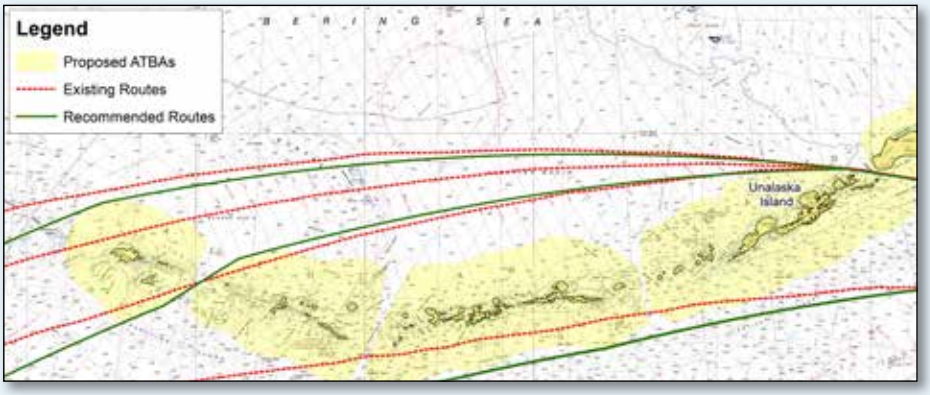
Adjusting Shipping Routes to Protect Critical Arctic Marine Habitat

Aleutian and Bering Sea Islands LCC, *https://absilcc.org/SitePages/home.aspx*

Thousands of deep-draft vessels transit the Aleutians annually along shipping routes between North America and Asia. In 2004 the M/V *Selendang Ayu*, a 740-foot bulk carrier vessel, lost power and drifted aground on the north shore of Unalaska Island in the eastern Aleutians. The vessel broke in two, claimed the lives of six crewmen, and spilled more than 300,000 gallons of heavy fuel oil and soybeans.

To reduce these risks, the Aleutian and Bering Sea Islands Landscape Conservation Cooperative (ABSI) conducted the first-ever analysis of these

See Landscape page 14



The Aleutian and Bering Sea Islands LCC is coordinating information with the U.S. Coast Guard to establish new shipping routes (top) that reduce shipwreck risk (left) and prevent associated impacts to wildlife such as oil spills (lower right) while minimizing additional shipping costs. Image credits: USFWS

Landscape continued from page 13

shipping routes and documented that many ships pass perilously close to these islands. The results informed a U.S. Coast Guard proposal to the International Maritime Organization (IMO) to establish five Areas To Be Avoided (ATBAs) in the Aleutians, applying to ships 400 gross tons and heavier, transiting the Great Circle Route on either the north or south sides of the Aleutian chain. The proposal was approved by the Navigation, Communication, Search and Rescue Subcommittee of the IMO, and is now moving forward to the Marine Environment Protection Committee for consideration in July 2015.

Further analysis of new vessel routes conforming to the proposed ATBAs, using distance as a proxy for exposure, indicates the new routes would reduce potential risk to seabird colonies by 17 percent and to Steller sea lion haulouts and rookeries by 21 percent while adding less than 1 percent to the length of the voyage. Additional analysis supported by the ABSI partnership is working to identify areas most at risk to vessel drift groundings, to inform spill response preparation, providing economic benefits as well as reducing risk to natural resources.

Connecting Healthy Waterways in the Mississippi River Watershed

Seven Landscape Conservation Cooperatives (LCCs) connect for farmers and fisheries

Seven LCCs are located within the Mississippi River Watershed. Coordination at this scale enhances benefits for multiple stakeholders. Image credit: USFWS

Highly productive soils from the Midwest to the Gulf of Mexico support vital and diverse natural resources. Climate change impacts create an uncertain future for both humans and wildlife, including water availability, crop selection, diminishing grasslands, carbon sequestration, pollination timing, and other valuable ecosystem functions. Loss of natural buffers that filter runoff in Midwestern states sends damaging nutrient loads down the Mississippi River that

See Landscape page 15

Grassland ecology and farming practices in the Midwest affect shrimp fisheries (inset) in the Gulf of Mexico. Coordinated landscape-scale management provides benefits all around. Photo credits: USFWS

Landscape continued from page 14

negatively impact shrimp and fish in the Gulf of Mexico.

Seven LCCs are coordinating the Mississippi River Basin / Gulf Hypoxia Initiative, a systematic and transparent process that integrates and supports the planning, design, and delivery of conservation practices within the enormous watershed. By leveraging a knowledge network of over 200 scientists and managers, these experts are combining needs of wildlife, water quality, and agriculture with conservation strategies for four ecological systems—prairies, headwaters in crop fields, mid-sized streams, and mainstem floodplains—and farming systems for corn and soybeans, grazing lands, floodplain forestry, rice, and cotton. This framework complements related efforts, such as the Gulf of Mexico Hypoxia Task Force and state nutrient reduction initiatives, but with an added emphasis on the ecological and social values of wildlife habitat.

Human dimensions experts are exploring how climate extremes affect farmers' preferences for adopting conservation practices that improve both water quality and wildlife habitat. Scenario planning could provide climate forecast and adaptation strategies in response to ecological or economic drivers. The resulting spatial analysis will target and align conservation work to enhance multiple benefits for humans and wildlife from inland prairies to coastal fisheries. *http://www.tallgrassprairielcc.org/research-projects/mississippi-river-basingulf-hypoxia-structured-decision-making-workshop-2014*

Tools to Inform Coral Reef Conservation in the Pacific Islands

Pacific Islands LCC, *http://piccc.net/*

The people of the Pacific Islands depend on coral reefs and marine resources for subsistence fishing, recreation, and vital tourism income. Climate change threatens these marine resources through major impacts like coral bleaching and ocean acidification. Recognizing the need to understand coral vulnerability and for a planning timeline, the local, state, federal and indigenous organizations of the Pacific Islands Climate Change Cooperative (PICCC) are focused on developing tools to inform adaptation strategies and timelines. The PICCC funded the development of a Google Earth tool to make climate change projections publicly accessible on-line. Available through NOAA's Coral Reef Watch website, this tool uses projections based on models from the IPCC 5th Assessment in order to visualize thermal stress trends and the change in aragonite saturation in a geospatial context. *http://coralreefwatch.noaa.gov/climate/projections/piccc_oa_and_bleaching/index.php*

By placing projected future reef temperatures and aragonite saturation changes on maps, resource managers and decision-makers can see the extent to which coral reefs will be impacted by the dual threats of coral bleaching events and ocean acidification. This provides the most up-to-date assessments of climate change impacts on coral reef ecosystems, and is essential for planning adaptation strategies. The tool can be used to identify potential refugia for coral, giving managers the best opportunities to temporarily protect coral reefs as well as develop long-term solutions. It has already been used to assess reef resilience, develop bleaching response plans, and help prioritize conservation and restoration actions to maximize protection of vital marine resources.

Chuuk--a tiny island fringed by extensive coral reef ecosystem is vulnerable to ocean acidification and warming temperatures. Photo credit: Jeffrey Maynard, Cornell University

Never before has collaborative conservation been implemented at the scale and with the commitment of the LCC integrated network. In the grand vision, the steps taken now will make it easier in the future for decision-makers to collectively understand the harm or benefits of specific actions and inform how best to prioritize them. Developing collaborative networks and partnership across multiple sectors takes time.

The LCCs are building connections and momentum to advance the vision and approach for conservation and adaptation. The potential conservation benefits are enormous.

Meeting Offshore Mapping Needs

By Christine Taylor, BOEM

A joint offshore mapping initiative provided by the Bureau of Ocean Energy Management (BOEM) and the National Oceanic and Atmospheric Administration (NOAA), ***MarineCadastre.gov***, makes access to extensive geospatial information easy.

This online resource provides authoritative geospatial data and maps from over 30 data providers to meet the needs of offshore energy and marine planning communities.

Map layers are provided as map services and downloadable GIS files for technical and non-technical users. Additionally, the system provides these same map services to other regional map and data portals, so that users of any of these systems are ensured that they are getting the most recent version of data available online even if they are not accessing the information directly from *MarineCadastre.gov*.

Information is presented in easy-to-understand cartographic representations and includes 250 coastal and ocean data layers, 15 special maps, an interactive map viewer and a searchable data registry. New and updated map layers are provided on a continuous schedule.

Map layers in MarineCadastre.gov are keyword searchable from the data registry or map viewer, and it doesn't matter if you start from the data registry or the map viewer, your data choices can be opened in the map viewer or in an *ArcGIS.com* (ESRI product) map. Users are able to make and share their own maps and can download or directly link to data for use in a GIS system,

The home page (inset) and example views of the geospatial datasets and powerful mapping capabilties available at your fingertips through the MarineCadastre. Map credits: Christine Taylor, BOEM

Stay connected!

MarineCadastre.gov

If you haven't been to the website in a while it has been updated considerably.

Choose the "Contact and Follow" tab and select one of the options. You can follow us via social media, receive quarterly updates, or ask the team a question.

view metadata, or review the data on the integrated map viewer or within ArcGIS.com. Both types of maps are shareable so that you can keep your work and revisit where you left off or send your map to a colleague by simply copying the active url. All of this is accessible via standard web browsers and on mobile devices. Access through *ArcGIS.com* allows the user to change the cartography and look of data as well as add other layers to the new map from other geospatial data sources.

If you are in a meeting and you don't remember if there is a critical habitat in your area of interest, you can look that up on your smart phone and it's just a website, not an app. All layers, when open in the map viewer, can be searched for underlying information using the ID tool. Just click on the map anywhere over your layer of interest and all the available information for all the layers under your cursor will appear and the area on the map will highlight.

If you want to draw points, lines, polygons or text on your map, you can do that too. The new map viewer allows users to reorganize layers so that some layers do not hide other active map layers. Change the opacity of a layer and see through one layer to another. There are four options to choose for the background basemap. You can also turn on Nautical Charts as a layer.

MarineCadastre.gov is not just a mapping site, it is a great way to learn how others use the geospatial data and catch up on news about the offshore energy and marine planning activities going on in U.S. waters. MarineCadastre.gov is the only mapping site that makes Automated Information System (ship tracking data) available in a format easily added to desktop GIS systems.

Large Scale Testing of Dispersants in a Simulated Arctic Environment

ByTimothy Steffek, BSEE

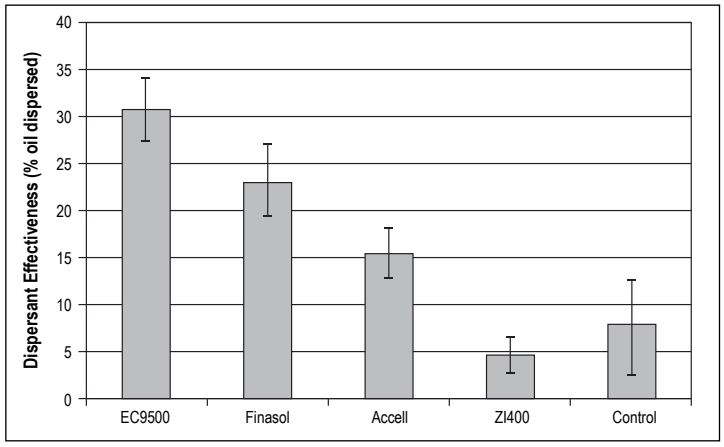
The Bureau of Safety and Environmental Enforcement (BSEE) works to promote safety, protect the environment, and conserve resources offshore. One way that BSEE protects the offshore environment is by maintaining a comprehensive, long-term research program dedicated to improving and evaluating oil spill response options. In February of 2014, researchers from BSEE conducted tests that compared the effectiveness of several commercially available dispersants under simulated arctic conditions. The results, currently under peer review, will help BSEE and its federal partners make decisions about the various dispersants being considered for use on the U.S. Outer Continental Shelf.

Dispersants are chemicals used to mitigate oil spills that help to break a surface slick of oil into small droplets, which more readily diffuse into the water column. The smallest droplets of oil remain in the water column, and can be more easily biodegraded by organisms such as zooplankton in the water. Additionally, dispersing oil helps prevent surface slicks from being spread by wind, and pushed towards sensitive coastal habitats.

Four dispersants were selected from the Environmental Protection Agency's (EPA) National Contingency Plan (NCP) Product Schedule and were tested on a surface slick of an Alaskan crude oil. Only dispersants listed on the NCP Product Schedule may be considered for use during an oil spill response. The dispersants tested were Corexit® EC9500A, Finasol® OSR 52, Accell® Clean DWD, and ZI 400. All testing was conducted in the Ohmsett testing facility in Leonardo, NJ. Ohmsett's above ground concrete test tank is a state of the art facility that holds 2.6 million gallons of seawater.

Dispersant effectiveness was compared as the percent reduction in volume of the oil slick before and after dispersant application, and as the proportion of droplets in the plume of dispersed oil that are small enough to remain in the water column. A range of performance was observed between the dispersants compared (see graph). Corexit EC9500A performed very well in this study, dispersing 31% of oil into droplets small enough to remain dispersed. Control trials and the dispersant ZI 400 dispersed only 7.6% and 4.7% of oil respectively. The crucial knowledge gained from this research is a proactive step that will help oil spill responders to chose the best performing dispersant during an emergency response.

Tim Steffek (BSEE) and Alan Guarino (Mar, Inc.) discuss the recently completed test while Ohmsett (the National Oil Spill Response Research and Renewable Energy Test Facility) technicians collect the remaining surface oil for further analysis. Photo credit: Jane Delgato of Mar, Inc.



The effectiveness of dispersant application, measured at the proportion of oil dispersed into the subsea plume as droplets small enough to remain in the water column (below 70 µm). The control test measured natural dispersion of oil, due to wave movements, with no chemical dispersants applied. Image credit: BSEE

The full report will be available on BSEE's website as Oil Spill Response Project number 1016 after an independent peer review of the findings is complete. To continue building an understanding of the various products available for use in the U.S., BSEE will conduct additional testing in October of 2015 to compare dispersant effectiveness on a Gulf of Mexico crude oil at moderate temperatures. *http://www.bsee.gov/Technology-and-Research/Oil-Spill-Response-Research/index/*

Coal-Tar-Sealant Runoff Causes Toxicity and DNA Damage

Implications for watershed health

Runoff from pavement with coal-tar-based sealant is toxic to aquatic life, damages DNA, and impairs DNA repair, according to two USGS studies.

"The USGS has been studying coal-tar-sealcoat as a source of polycyclic aromatic hydrocarbons (PAHs) for 10 years, and findings from these two studies are consistent with what is known about toxicity and genotoxicity of these chemicals," said USGS scientist Barbara Mahler.

Pavement sealants that contain coal tar have extremely high levels of PAHs. Coal tar is a known human carcinogen; several PAHs are probable human carcinogens and some are toxic to fish and other aquatic life. The studies were done to address the concern that rainfall runoff occurring within hours or days of coal-tar-based sealant application might be toxic to fish and other organisms in streams. The two studies collected and tested simulated runoff at various times beginning just hours after coal-tar-sealant application. Rainwater runoff collected as long as three months after coal-tar-sealcoat application caused 100% mortality to minnows and water fleas, which are part of the base of the food chain, when the test organisms were exposed to ultra-violet radiation to simulate sunlight.

Exposure of fish cells to coal-tar sealant runoff damaged their DNA and impaired the ability of the cells to repair DNA damage.

Coal-tar based sealcoat that is painted or sprayed on asphalt pavement can affect the quality of downstream water resources. Runoff from coal-tar based sealcoated parking lots have PAH concentrations that are about 65 times higher than in particles washed off parking lots that have not been sealcoated. These PAH concentrations have been increasing over the past 30-35 years in many urban and suburban lakes across the United States. Photo credit: USGS

"The simultaneous occurrence of DNA damage and impairment of DNA repair has important implications for cell health," said Sylvie Bony, who led the study at the Ecole Nationale des Travaux Publics de l'Etat (ENTPE), a French research agency in Lyon, France. The study is reported in the scientific journal Science of the Total Environment.

Coal-tar sealants have significantly higher levels of PAHs and related compounds compared to asphalt-based pavement sealants and other urban sources, including vehicle emissions, used motor oil, and tire particles. Previous studies have concluded that coal-tar sealants are a major source of PAHs to lake sediments in commercial and residential settings, and that people living near pavement sealed with coal-tar sealant have an elevated risk of cancer. *http://www.usgs.gov/newsroom/article.asp?ID=4190#.VVJEfyFVikp*

Read more:*http://water.usgs.gov/nawqa/asphalt_sealers.html*

The full study, reported in the scientific journal Environmental Science and Technology, is available online. *http://pubs.acs.org/doi/abs/10.1021/acs.est.5b00933*

Pavement sealant is a black liquid that has extremely elevated concentrations of polycyclic aromatic hydrocarbons (PAHs). It is sprayed or painted on the asphalt pavement of parking lots, driveways and playgrounds to improve appearance and protect the underlying asphalt. Photo credit: USGS

Virus is Culprit in Sea Star Disease

By Ben Young Landis, USGS

Apart from SpongeBob's pal Patrick, it's hard to think of sea stars as living creatures. They're sold in beachcombing shops as rock-hard, dried specimens for home décor, and artists use their symmetric shapes as motifs for ocean-inspired patterns. But sea stars are actually soft-bodied, colorful, mobile animals that hunt and feed on the ocean bottom, and since 2013, a mysterious disease has been killing them in droves along the U.S. and Canadian Pacific Coast—causing their arms to fall off and spilling their innards, wasting away their bodies as if a heat gun were melting them from the inside.

"Last January, I was diving in my local kelp forest and came across hundreds of dying and decomposing sea stars. Now I can't find a single sea star," says USGS scientist Kevin Lafferty, who is based at the University of California-Santa Barbara's Institute of Marine Sciences as adjunct faculty.

The "Sea Star Wasting Disease" behind this deadly epidemic has been intensely studied by marine scientists in recent months, and now, a prime suspect has finally been identified as a probable cause.

Researchers from Cornell University, U.S. Geological Survey, and other institutions managed to isolate and analyze the genome of a previously unidentified virus in the sick sea stars. They published their findings on this "sea star associated densovirus (SSaDV)" in the Proceedings of the National Academy of Sciences . *http://www.pnas.org/content/111/48/17278.abstract*

At left- A healthy sea star. Photo credit: Mandy Lindeberg, NOAA
At right- A sea star affected by the sea star wasting disease. Photo credit: Melissa Miner, University of California, Santa Cruz

Sea star die-offs have been observed in past decades, but none were at this geographic scale. Since June 2013, Sea Star Wasting Disease cases have been reported from Baja California all the way to southern Alaska. As many as 20 sea star species have been affected.

Read more: *http://soundwaves.usgs.gov/2015/02/*

http://www.usgs.gov/environhealth/headlines/2015-01-16-sswd.html

Sea Star Wasting Disease

"Because it's happening underwater, this devastation may be difficult for many people to picture, but imagine if all the songbirds from Alaska to Mexico started falling out of the sky, dropping their wings and disintegrating into a pile of feathers."

USGS Scientist Kevin Lafferty

Illustration credit: Cole Goco

Monitoring for Sea Star Wasting Disease in the Northern Gulf of Alaska

By Erin Kunisch and Heather Coletti, NPS

Sea stars play a vital role in shaping the marine communities in which they live. Many sea stars are considered top level predators, and have earned the title of being a keystone species. Keystone species are species that have a dramatic impact on community structure.

Sea star wasting disease can move through sea star populations like a wildfire moves through a forest, and can kill many different species of sea stars at the same time. While scientists have recently identified sea star associated densovirus (SSaDV), to be a cause of this widespread disease, they still do not know what is causing it to spread so rapidly.

In the summer of 2014, the Gulf Watch Alaska (GWA) team searched for sea star wasting disease in the northern Gulf of Alaska. Team members surveyed almost 2,000 sea stars at 24 different sites and found no diseased sea stars. Survey sites were located in Prince William Sound, Kenai Fjords National Park, Kachemak

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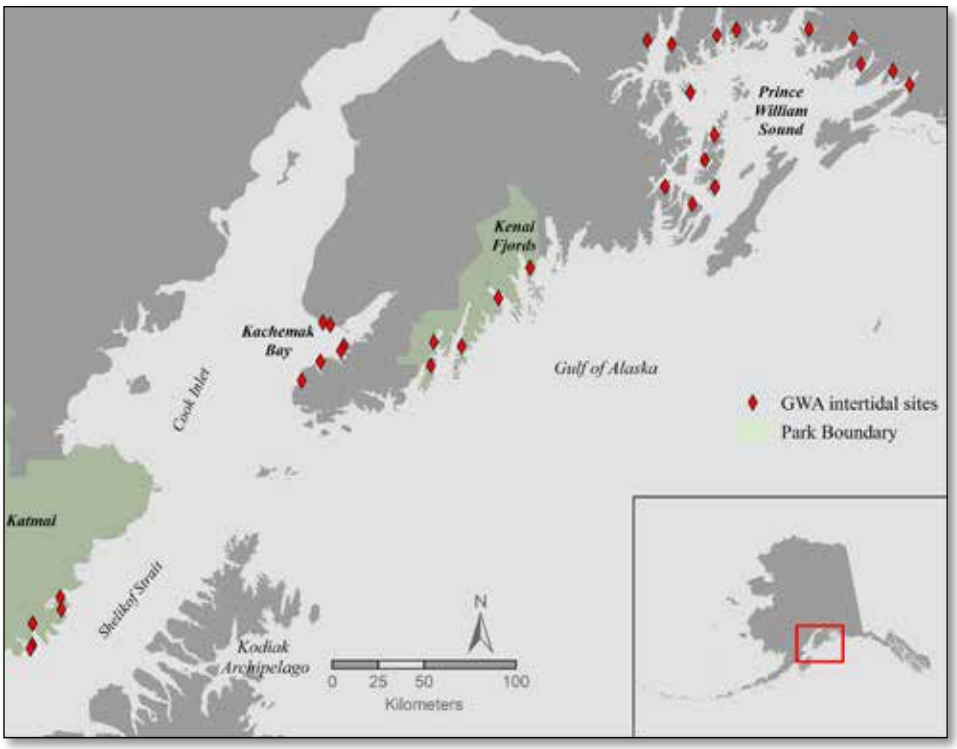


A map showing Gulf Watch Alaska's intertidal sampling sites within the Gulf of Alaska. Map credit: Heather Coletti, NPS

Gulf of Alaska continued from page 19

Bay, and Katmai National Park and Preserve. Additionally, a GWA team member conducted research dives at multiple sites in the central and western Aleutian Islands, and found no signs of wasting disease.

However, in May 2015, two GWA scientists discovered a small group of sea stars stricken with this wasting disease in Kachemak Bay. GWA researchers will be looking across the northern Gulf this summer for other areas that may have become infected.

Above- A baby sea otter pup is just one of many species scientists may encounter as they conduct monitoring surveys. Photo credit: Mandy Lindeberg, NOAA

At left- The Gulf Watch Alaska research team is hard at work measuring and monitoring the biodiversity of plants and animals exposed during low tide. Photo credit: Mandy Lindeberg, NOAA

Gulf Watch Alaska

From sea stars to sea otters, the nearshore program of Gulf Watch Alaska monitors a suite of plants and animals found along the coast of the Gulf of Alaska.

Every summer during the lowest tides, a team of scientists visit multiple sites to document the number and diversity of the plants (seaweeds and algae) and animals (mussels, crabs, and more) that live in these nearshore areas and form the foundation of the nearshore food web. Gulf Watch Alaska also studies the various predators that rely on this narrow band along the coast, including sea stars and sea otters. The intent of this research is to better understand the factors that influence nearshore species and communities, as these were the hardest hit by the Exxon Valdez oil spill in 1989. The nearshore also supports important resources for subsistence, commercial, and recreational use.
http://www.gulfwatchalaska.org/

This work is possible through collaboration between *Exxon Valdez* Oil Spill Trustee Council, U.S. Geological Survey, National Park Service, University of Alaska Fairbanks, and National Oceanic and Atmospheric Administration.

Protecting Sea Turtles with Wildlife-Friendly Lighting

By Nanciann Regalado, NRDA

Since the day of the spill, the Deepwater Horizon Natural Resource Damage Assessment trustees have worked to uncover how the Gulf environment and its wildlife were injured and at the same time, trying to restore injured resources to their pre-spill condition (*see related story page 22*).

Sea turtles were one of the many kinds of wildlife oiled and killed by the Deepwater Horizon disaster. Two years ago, the trustees approved an early restoration project that is helping nesting sea turtles. A $4.4 million project will be replacing land-based white lights with amber light emitting diodes (LEDs) in many nesting locations along the Florida and Alabama coasts.

Lighting can make all the difference in determining the future of sea turtle hatchlings. That's because sea turtles typically hatch at night and are drawn to the light of the moon and stars as it is reflected off the ocean. The bright white lights along developed shorelines can cause hatchlings to get turned around. Amber colored LEDs greatly reduce this effect. While LEDs have been available at home improvement stores for a while, it wasn't until recently that a manufacturer was able to produce a commercially applicable amber LED and fixture that is certified as wildlife friendly.

New LED light fixtures make Casino Beach more turtle-friendly. Photo credit: USFWS

"Sea turtle eyes are adapted to see underwater where they spend most of their lives," said Ben Frater, U. S. Fish and Wildlife Service restoration biologist and turtle lighting project project manager. "They don't have the ability to see amber or red wavelengths so they simply don't see the light coming from the LEDs. That's why these LEDs don't attract the sea turtles." The LEDs are more efficient than the old lighting; they will cost a fraction of traditional lighting and they are expected to last 15 years.

Sea turtles hit the jackpot at the Casino Beach public parking lot on Florida's Santa Rosa Island. Gulf Power, the Santa Rosa Island Authority, and Escambia County are partnering with the trustees to complete the replacement of twenty-one 35-foot concrete light poles with 38 shorter ones outfitted with the new LED light fixtures. "Everyone here is turtle-friendly. So we're happy these lights will help turtles," said W.A. "Buck" Lee, Santa Rosa Island Authority's Executive Director.

Female Kemp's ridley nesting at Padre Island National Seashore, Texas. Photo Credit: USFWS

Understanding Deepwater Horizon's Impact on Kemp's Ridley Sea Turtles

By Nanciann Regalado, NRDA

See related story page 21

Following the Deepwater Horizon oil spill in April 2010, the Natural Resource Damage Assessment (NRDA) trustees began, augmented, or expanded long-running studies to assess the spill's impacts on wildlife, including the endangered Kemp's ridley sea turtle. An extensive pre-spill database of Kemp's ridley research provides an important source of baseline information to compare with post-spill data as part of the NRDA.

While the complete story is still unfolding, data analyses for the NRDA are ongoing and will be used to determine the liability of responsible parties for injury to endangered sea turtles, as well as to their habitats and prey. Field and laboratory tests and tracking turtles contribute to understanding exposure to and injury resulting from Deepwater Horizon oil.

Researchers attach a satellite transmitter to a female Kemp's ridley turtle. Photo credit: Texas Parks and Wildlife.

Assessing Turtle Eggs

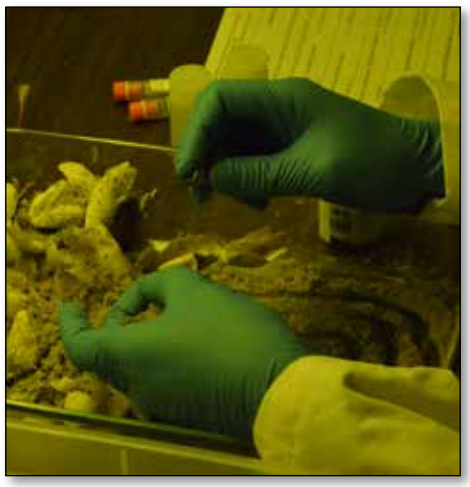
National Park Service staff have worked for decades to increase nesting by Kemp's ridleys. Donna Shaver, PhD, chief of the Padre Island National Seashore Sea Turtle Science and Recovery Division, led a team that collected more than 2,100 samples from adult and unhatched turtle eggs for analysis of exposure to oil from the spill. USGS investigators led experts from government and academic laboratories in the analyses.

Where do they go?
Watch a five-month journey of turtle 47562 in the Gulf of Mexico *https://www.youtube.com/watch?v=0M8xIqg6A3w&feature=youtu.be*

To follow the movements of sea turtles being tracked with satellite transmitters, visit: *www.seaturtle.org/tracking* **select "Padre Island National Seashore Kemp's Ridley Tracking Program-2012." This site includes maps and data showing the movements of 10 turtles tagged with satellite transmitters.**

Turtle Telemetry Tracking shows Important Migratory Patterns

During the nesting season, female turtles that came ashore to nest were fitted with satellite transmitters so researchers could track their movement. Satellite tracking of the Kemp's ridleys began in 1997 in an effort to promote the recovery of a species on the brink of extinction. This historical monitoring revealed that after the nesting season, most of the tracked turtles left south Texas and traveled northward, parallel to the coast, with their last identified location in the northern or eastern Gulf of Mexico. Recent tracking data shows similar migratory habits.



Lab technicians take samples from sea turtle eggs that did not hatch. Photo Credit: USFWS

"The area off the coast of Louisiana has a high concentration of foraging females," noted Shaver. Her work and the work of USGS biologist Dr. Kristen Hart, has shown that critical sea turtle foraging areas and migration routes overlap significantly with the area affected by floating oil from the spill.

Nesting Trends

Due to many years of conservation work in Mexico and the U.S., Kemp's ridley nesting increased 12-19 percent per year from the 1990s through 2009. With these recovering trends biologists believed the species could likely be downlisted to threatened status in a few years.

However, beginning in 2010, nesting declined significantly. Annual nest numbers in Mexico and Texas rebounded during 2011 and 2012 to levels relatively similar to 2009 but during 2013 and 2014 they decreased. In fact, 2014 nest numbers fell to an eight-year low. Supported by data collected for the NRDA as well as from ongoing studies of the past 25 years, these findings may prove quite important to spill researchers.

Sunia Internship Program

Hands-On Coral Reef Conservation Experience in the Caribbean and Pacific Islands

By Silmarie Padron, USFWS

Formally named the Governor Tauese P.F. Sunia Memorial Coral Reef Conservation Summer Internship, the 'Sunia Internship' was created in recognition of American Samoa's Governor Sunia for his outstanding leadership and contribution to conserving coral reef ecosystems. The late Governor is most remembered for being an eloquent and impassioned advocate for coral reef protection and management, not only in American Samoa, but throughout the Pacific region and the United States. The 11-week internship program has been sponsored by the United States Coral Reef Task Force (USCRTF) since 2004.

The Sunia Internship program continues the Governor's legacy by providing outstanding college or university students the unique opportunity to gain professional experience in natural resource management and conservation of coral reef ecosystems. Interns also contribute to the overall efforts of USCRTF initiatives. In 2011 the program was restructured to have interns directly involved with on-the-ground activities in the three priority watershed initiatives identified by the USCRTF (Guánica Bay – Rio Loco in Puerto Rico, West Maui, Hawaii, and Faga'alu in American Samoa). Through this focus, Sunia Interns gain experience in fostering local capacity building by training and teaching the intricacies of implementing local conservation actions.

Sunia interns, Yasiel Figueroa Sanchez (left) and Nancy Cardona (right), from the University of Puerto Rico, presented their internship findings and accomplishments to the 33rd Meeting of the USCRTF, held in Washington, D.C. in February 2015. Photo credit: Ann Tihansky

They also work to build a better understanding of federal, state, and local agencies' functionalities and the importance of partnerships to achieve common goals.

In addition to their field projects, the interns have the opportunity to present their work to the USCRTF members during annual meetings. The internship program is led by the U.S. Fish and Wildlife Service (USFWS) and the American Samoa Coral Reef Advisory Group with funding from USFWS and the DOI's Office of Insular Affairs. Additional support has also been provided from other USCRTF members including USDA-NRCS, NOAA, EPA, state agencies and local organizations.

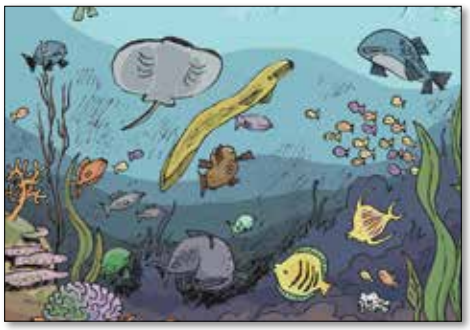


Illustration credit: Cole Goco

Spotlight on 2014 Sunia Interns

During the summer of 2014, five students were recruited as part of the Sunia Internship program (*see related story*). Two worked in the watershed in West Maui, Hawaii and three worked on various projects in Puerto Rico.

In West Maui, interns worked on a project identifying potential areas for post-fire restoration and habitat restoration using hydro-seeding techniques. They also compiled data to create a visual image of all the known conservation actions within the West Maui watershed.

In Puerto Rico, interns worked on three projects: 1) conducting a biodiversity assessment along the Rio Loco Watershed, 2) measuring the effectiveness of hydro-seeding techniques used in habitat restoration, and 3) providing assistance to EPA in developing a coral reef species sensitivity library and database for the Caribbean area.

Sunia interns Yasiel Figueroa Sanchez and Nancy Cardona, visited Washington, D.C. to attend the U.S. Coral Reef Task Force meeting where they presented their projects to the Task Force members. They also had the opportunity to present their accomplishments to leadership officials in USFWS and NOAA, and shadow them to experience a typical day as an Assistant Director or Assistant Administrator.

Tools to Enhance Resilience to Climate Change

By Sarah Abdelrahim, DOI

From saving tidal marshes in the San Francisco Bay that are vulnerable to sea level rise to setting conservation priorities along the South Carolina coast, you can find dozens of examples of how state and local governments, communities, and businesses are thinking about climate change impacts on the U.S. Climate Resilience Toolkit website. For many people, these examples provide decision-makers and interested citizens with a starting point in understanding how to address climate change.

The Climate Resilience Toolkit is a key initiative of the President's 2013 Climate Action Plan. It is intended to help communities address a range of issues, including coastal flooding, human health, food resilience, ecosystem vulnerability, and water security. Launched

https://toolkit.climate.gov/

http://www.data.gov/climate/

in November 2014 as a dynamic website, it serves a central point for authoritative climate data and information from across the federal government. The Toolkit provides a five-step framework for addressing climate change impacts, which can help decision-makers organize the actions needed to build resilience. The Toolkit links to a number of datasets, decision-support tools, and visualizations that can help communities address climate change.

Coastal and ocean managers can access many tools to help with their planning efforts. For example, the OceanAdapt Web Tool can help managers understand the changes in the distributions of nearly 650 marine species with changing climate and ocean conditions. *http://toolkit.climate.gov/tool/oceanadapt* The Coastal Change Hazards Portal allows you to view past, present, and future coastal change hazards, which can support smart coastal development and ecosystem restoration. *http://toolkit.climate.gov/tool/coastal-change-hazards-portal* Additional tools and summaries of the tools can be found on the website and can be searched by sector or topic of interest.

With strong leadership from NOAA, many other agencies such as the Department of the Interior, Department of Health and Human Services, and USDA have been working together to build the Toolkit. It is a good example of how government agencies can collaborate to deliver coordinated services to the public.

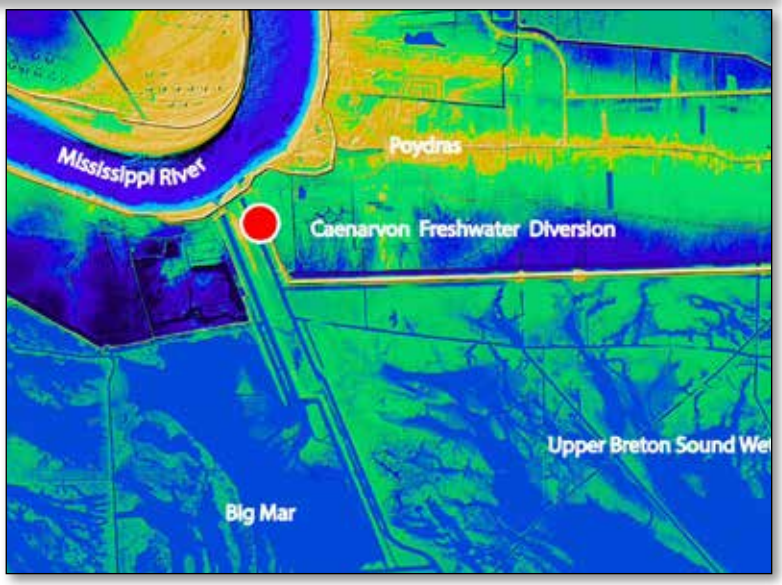
The Toolkit's sister effort, the Climate Data Initiative, which is

See Toolkit page 26

Topobathymetry

By Cindy Thatcher and John Barras, USGS

USGS has developed an integrated, high resolution topobathymetric digital elevation model for the Northern Gulf of Mexico to provide enhanced 3D Elevation Program data in the coastal zone.



Map image credit: Dean Tyler, USGS-EROS

Accurate, comprehensive, and up-to-date elevation data are a fundamental requirement for the development of sea-level rise and flood inundation maps, and to inform coastal restoration and flood risk reduction efforts along this highly dynamic and low-lying coastal region. The map highlights topobathymetric elevation data for a section of the Mississippi River south of New Orleans, an area near or below sea-level that is surrounded by developed areas and wetlands, separated by a complex system levees and channels. The Caernarvon Freshwater Diversion is located just south of the bend in the Mississippi River and discharges into wetlands south of the river. The digital elevation model is available at: *https://lta.cr.usgs.gov/coned_tbdem* Contact John Barras for additional information, jbarras@usgs.gov

Satellite Technology Informs Redhead Duck Conservation on the Texas Gulf Coast

By Craig Springer, USFWS

New satellite tags help scientists and managers understand how best to manage redhead duck habitat. The National Wildlife Refuge System - Inventory and Monitoring helped fund this research. Photo credit: USFWS

The redhead duck is arguably among the handsomest of waterfowl. That is of course a matter of opinion. But here's a fact: eighty percent of all North American redhead ducks spend their winters concentrated along the lower Gulf Coast of Texas in the Laguna Madre. They feed on shoalgrass in the Laguna and fly inland to purge excess salts. Redheads, like most birds that feed in saltwater have a salt gland near the eye that excretes excess salts ingested while feeding. It is essential that salt be purged daily in freshwater ponds. And knowing the array of habitats frequented by the bird during south Texas winter sojourns is essential for their management.

USFWS scientist Dan Collins is as much a geographer as he is a wildlife biologist. Avian fauna are Collins' forte. He is waist-deep in remote-sensing—using photovoltaic cells, satellites, GPS, and Doppler radar to find and follow the position of ducks. The technology lends an amazing advantage in learning how birds behave and how wildlife managers can make better informed decisions at fine scales.

For Collins, birds are a way of life. He studies them and he hunts them—turkey, waterfowl and upland. A stringer of northern shoveler, green-wing and blue-wing teal are preserved in a beautiful taxidermy mount on his office wall from a memorable hunt years ago. Five steps away two computer monitors sport spreadsheets and maps with real-time satellite imagery—all duck data. Collins literally follows individual ducks using satellite tags. The tags have to endure the rigors of flight and the pressure of water given that redhead ducks dive to find food. Tiny photo cells need four hours of sunlight per week to charge the small transmitters attached to ducks. Each tag isn't cheap – about $3,700 a piece – so birds are not tagged en masse. The quality of the information is worth the expense.

A map with blue dots superimposed with data from the ground; including waterfowl habitat types and locations of wind-energy turbines—tell the tale. Each dot represents a redhead duck sending a signal into space to a satellite. The satellite relays the information back to the ground for Collins and collaborating researchers at Texas A&M University. It's the time and space in between each data point that reveals what ducks do on their winter grounds.

The data for the first season show the birds have an aversion to turbines. "We've documented turbine avoidance," said Collins, speaking to the presence of wind farms near redhead habitats. "It's good they don't fly into them, but there's more to it. The turbines affect habitat use, they seem to displace birds, and that could lead to birds leaving wintering habitat in poorer condition."

Redhead ducks heading to summer breeding grounds in Canada, the Dakotas and Montana, arriving there less fit could make the bird less successful on the nest. That remains an unknown. Only large males were tagged in this present research, said Collins—birds that could physically handle the tags.

"New, smaller tags are coming," Collins says. That will allow tagging of more birds, females included. The picture of habitat use should become clearer. This much is clear already: "The data revealed what areas are important for conservation outside of the wind farms," said Collins, "and where best to engage our partners—where habitat enhancement and restoration would be most beneficial for the birds going forward."

So far, the remote-sensing techniques are making wildlife managers much more informed.

www.fws.gov/southwest/migratorybirds

Regional Contacts

DOI leadership supports state-led regional ocean partnerships (ROP's), as well as Federal-state-tribal partnerships for regional marine planning. Five geographic regions now have operational regional planning bodies (RPBs): Northeast, Mid-Atlantic, Caribbean, the Pacific Islands and the West Coast.

Gulf of Maine
Susan Russell-Robinson (USGS)
(U.S.,Canada)
ROP: *http://www.gulfofmaine.org/2/*

Mid-Atlantic
Bob LaBelle (BOEM)
Leann Bullin (BOEM)
(New York, New Jersey, Delaware, Pennsylvania, Maryland, Virginia)
RPB: *http://www.boem.gov/Mid-Atlantic-Regional-Planning-Body/*
ROP: *midatlanticocean.org*

West Coast
Joan Barminski (BOEM)
Ellen Aronson (BOEM)
(California, Washington and Oregon)
RPB: *www.westcoastmarineplanning.org*
ROP: *www.westcoastoceans.org*

Northeast
Bob LaBelle (BOEM)
Leann Bullin (BOEM)
(Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut)
RPB: *neoceanplanning.org*
ROP: *northeastoceancouncil.org/*

Great Lakes
Phyllis Ellin (NPS),
Norman Grannemann (USGS)
Charlie Wooley (USFWS)
(Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin)
Great Lakes Research Initiative:
www.epa.gov/glnpo/glri/
ROP: *www.cglg.org/*

Alaska/Arctic
Jim Kendall (BOEM)
(Alaska)

Gulf of Mexico
Linda Walker (USFWS)
(Alabama, Florida, Louisiana, Mississippi, Texas)
ROP: *www.gulfofmexicoalliance.org*

Caribbean
Sherri Fields (NPS)
(Puerto Rico, U.S. Virgin Islands)
ROP: *http://www.drna.gobierno.pr/oficinas/arn/recursosvivientes/costasreservasrefugios/pmzc/crop*

Pacific Islands
Richard Hannan (USFWS)
(American Samoa, Commonwealth of Northern Mariana Islands, Guam, Hawaii)
RPB: *www.PacificIslandsRPB.org*

South Atlantic
Eric Strom (USGS)
(North Carolina, South Carolina, Georgia, Florida)
ROP: *www.southatlanticalliance.org*

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also part of the President's Climate Action Plan, builds on the government's efforts to improve open access to data. Using the federal government's open data platform (Data.gov), the Climate Data Initiative (CDI) has provided access to more quality, federal government datasets that can help in responding to climate change impacts. The CDI has also more effectively tagged and categorized the data, in order to make it more discoverable to people in many sectors. The CDI is intended to stimulate innovation, and a number of private sector commitments and public-private partnerships have been announced since the CDI website was unveiled in early 2014.

Together, efforts like the Climate Data Initiative and the Climate Resilience Toolkit help centralize the multiple federal government resources to build the Nation's capacity to address climate change. Federal government agencies welcome feedback on these initiatives. They will continue to evolve based on the information needs of decision-makers.

Illustration credit: Cole Goco

At center, USCRTF co-chairs Lori Faeth (DOI) and Eileen Sobeck (NOAA) address the USCRTF Principal Members and meeting attendees. Front row from left to right: Kevin Claridge (Florida Department of Environmental Protection), John Cruden (DOJ) Carmen Guerrero Perez (Puerto Rico Department of Natural and Environmental Resources), Don Schregardeus (DoD – Navy), Governor Calvo (Guam), Lori Faeth (DOI), Eileen Sobeck (NOAA), Jean-Pierre Oriol (USVI Department of Planning and Natural Resources) and Jo-Ellen Darcy (DoD – USACE). Photo credit: Ann Tihansky, DOI

Coral continued from page 3

During the public Business Meeting, several of the USCRTF's interagency working groups provided updates on ongoing projects. The Climate Change Working Group (CCWG) presented an update on the Corals and Climate Adaptation Planning Project (CCAP). CCAP is a collaborative effort to take high level adaptation guidance and translate that information into a framework that can be used by local coral reef managers for adaptation planning. In July 2014, the CCWG tested a draft CCAP framework that integrates climate change adaptation principles with ongoing advancements in coral reef management during a stakeholder workshop in Honolulu, HI. Workshop participants used the West Maui watershed as a case study to further develop a climate-smart design tool for managers.

The USCRTF Ocean Acidification sub-working group within the USCRTF's Climate Change Working Group, hosted a panel of distinguished speakers made up of members from the California Ocean Science Trust, NOAA, EPA, and the Department of State who promoted the linking of scientific findings to management actions and regulation and policy decisions. The panel highlighted the importance of climate change, ocean acidification, and elevating awareness of these issues and their impacts on coral reefs and other marine organisms.

The Injury, Response and Mitigation working group provided an update on the much anticipated Handbook on Coral Reef Impacts: Avoidance, Minimization, Compensatory Mitigation, and Restoration. While not regulatory in nature, the handbook will provide guidance for handling a coral reef injury event and/or events needing coral reef mitigation. The Handbook includes commonly used mitigation and restoration options and practices, with case studies and lessons learned. This handbook is currently under review and is scheduled for release during the fall of 2015. The USCRTF is currently planning its next bi-annual meeting to be held in October 2015 in Puerto Rico which will focus on key issues impacting coral reef ecosystems in Puerto Rico and the wider Caribbean region.

www.coralreef.gov

Funding Opportunities for Tribes

Support to Address Climate, Ocean, and Coastal Issues

Rapidly changing climate conditions are already impacting tribes. The challenges of planning for and adapting to future climate impacts span the entire range of tribal government functions and traditional use.

Ocean and coastal management issues create unprecedented challenges within tribal communities. Tribes have both both immediate and long term needs as they build ocean and coastal planning capacity to address climate change impacts.

During the spring of 2015, the Bureau of Indian Affairs announced two funding opportunities to support ocean, coastal, and Great Lakes activities through the Tribal Cooperative Landscape Conservation Program. (*see related story page 13).*

The first announced award opportunities up to $8 million dollars to support Climate Adaptation Planning and Ocean and Coastal Management Planning (including the Great Lakes) within Federally Recognized Tribes and tribal organizations whose proposals are supported by a tribal resolution. The second was announced in May 2015 and will award up to $1.75 million to support tribal youth working on projects or performing research directly related to climate change impacts, or ocean and coastal management, including the Great Lakes. Proposals for this funding opportunity are due for submission by June 22nd. *http://www.indianaffairs.gov/WhoWeAre/BIA/climatechange/index.htm.*

Science and Tools to Support Planning in Coastal and Marine Areas:

http://marinecadastre.gov/

http://marine.usgs.gov/coastalchangehazards/

http://woodshole.er.usgs.gov/project-pages/coastal_model/

http://woodshole.er.usgs.gov/project-pages/mobility/

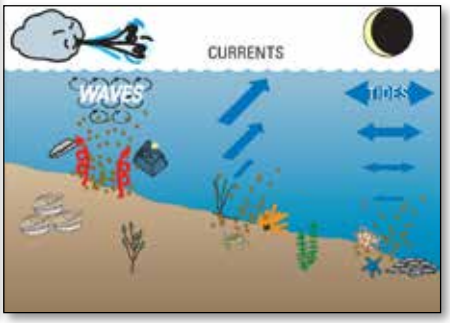
By Fran Lightsom, USGS

Planning in coastal and marine environments involves access to a wide range of information. Different stakeholders need many different types of information and the ability to combine data from multiple sources to answer complex questions. Here are a few examples of applications where scientists are developing tools that manage and provide access to data with interactive platforms to run models and help visualize geospatial information to serve the coastal and marine planning community. *(See related stories page 5 and throughout this issue for more examples of scientific tools, applications, and mapping resources)*

PLANNING FOR COASTAL HAZARDS

Coastal managers need to anticipate local risks of severe storms, shoreline change, and sea-level rise in order to plan and prepare. USGS has launched a website that provides this information for the whole U.S. coast, enabling planners to quickly identify what is relevant to their location then share it with colleagues or download it for further use.

At left is a sample image from the USGS Coastal Change Hazards Portal showing historical shoreline change at Cape Hatteras, North Carolina (see small inset map). *http://marine.usgs.gov/coastalchangehazards/*



DATA FOR MANAGING SUBMARINE ENVIRONMENTS

At left is a schematic showing various forces that can move sediments and impact submarine environments.

Currents and waves cause stress on the seafloor that can affect sediments, structures, plants, and animals, as well as human use. Large waves, especially those with long periods, can affect the seafloor across the entire continental shelf; some of these waves may be caused by storms far offshore. The motion of sea floor sediments like sand and mud can change submarine and coastal features, destabilize marine structures, transport anthropogenic substances, and determine the suitability of habitats for numerous species.

Marine planning requires estimates of sea floor stress and sediment mobility to advise many kinds of management activities. USGS scientists are developing, using and sharing numerical models to provide estimates of sediment transport over large areas and for various timescales. *http://woodshole.er.usgs.gov/project-pages/mobility/*

MODELS TO PREDICT IMPACTS FROM STORMS and SEA-LEVEL RISE

Numerical models are essential for predicting impacts of future storms and sea level on our coasts.

At lower right, USGS scientists used these kinds of models to help National Park Service archaeologists protect and preserve the wreck of the HMS Fowey in Key Biscayne National Park. NPS archaeologists use SCUBA to survey the shipwreck. Photo credit: NPS

Access coastal ocean models and other software tools to support marine planning activities: *http://woodshole.er.usgs.gov/project-pages/coastal_model/research-activities/nationalparks.html* and *http://woodshole.er.usgs.gov/project-pages/coastal_model/*