COASTAL SERVICES

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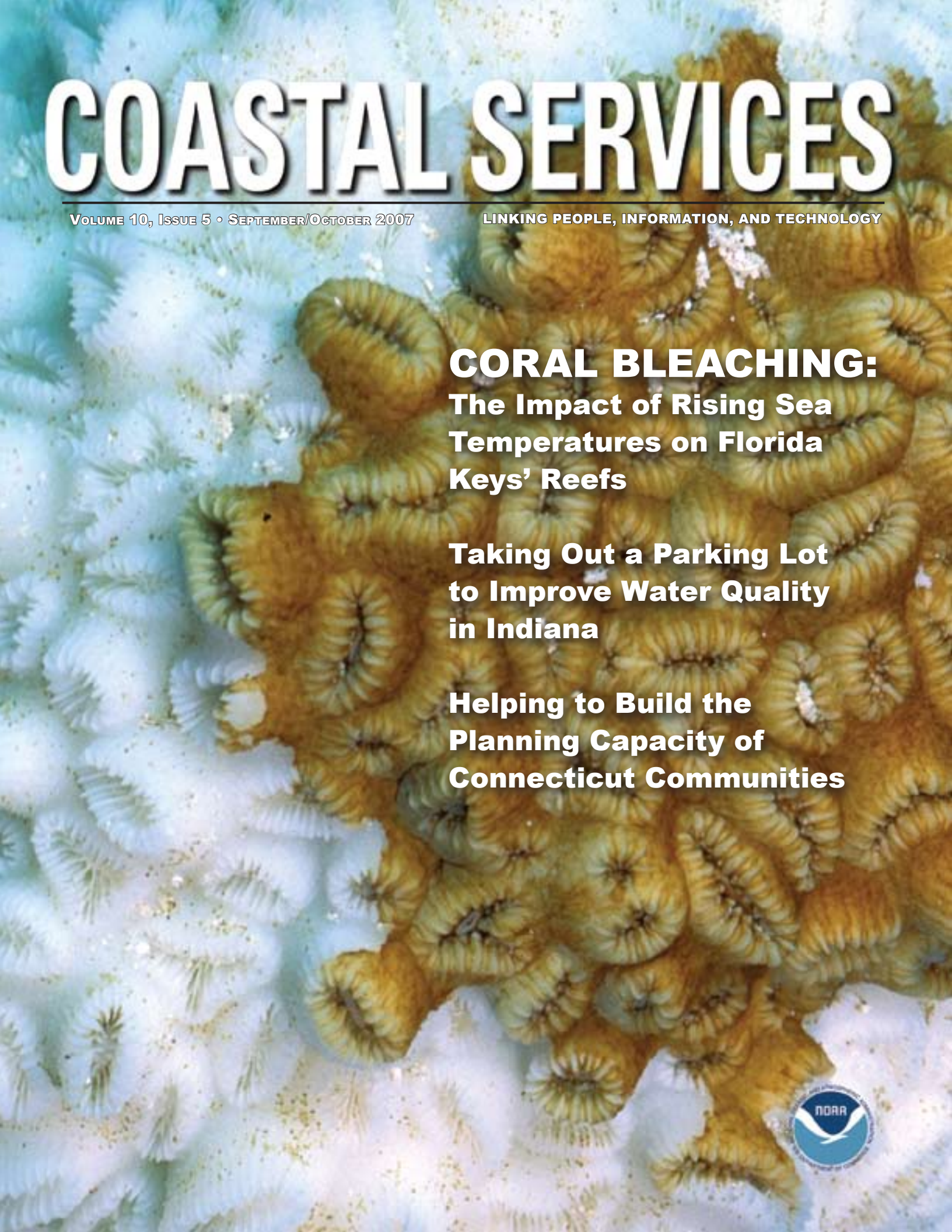
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY



CORAL BLEACHING: The Impact of Rising Sea Temperatures on Florida Keys' Reefs

Taking Out a Parking Lot to Improve Water Quality in Indiana

Helping to Build the Planning Capacity of Connecticut Communities

From the Director

Everything is connected. And coordination and partnerships should be embraced as among the most effective ways to do business.

These should be part of the take-home messages from the cover story of this edition of *Coastal Services* on coral bleaching in the Florida Keys.

Everything coastal resource managers are doing to protect the coastal zone and the environment onshore is going to help protect coral reefs and the environment offshore. The interconnectedness is huge. What is flushing through the heartland of America, down the Mississippi, and out into the Gulf of Mexico will float by the Florida Keys coral reef 10 days later.

Reducing nonpoint source pollution, habitat loss and degradation, and overfishing are just some of the things that coastal resource managers are doing that will help our valuable natural ecosystems better survive the impacts of climate change.

Part of coastal managers' role in addressing climate change is following best practices across the board and developing strong communication and collaboration with local, state, and regional managers, scientists, and other decision makers, as well as the media and public, that will help move our planet toward sustainability.

We have a lot to learn from managers in the Florida Keys who have been seeing the impacts of climate change firsthand and have been working hard to get in front of the issue.

Other articles in this edition include a habitat restoration project in Indiana that may help improve water quality in an adjacent swimming beach, a website in Connecticut that is helping communities develop an inventory of natural, cultural, and economic resources, and the California Sea Grant website where both industry and consumers can find the latest, best, and most comprehensive information on seafood safety and quality.

The goal of *Coastal Services* is to highlight information about coastal management issues and successful management programs as a way to help managers communicate with and learn from each other.

Let us know what you think of the stories in this edition—and if you have ideas for future articles.

Margaret A. Davidson

The mission of the NOAA Coastal Services Center is to support the environmental, social, and economic well being of the coast by linking people, information, and technology.

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Coastal Services Center

cover photo: © Wolcott Henry, 2005/Marine Photobank

Back issues of *Coastal Services* can be viewed at *www.csc.noaa.gov/magazine/*

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News and Notes

Serving Up Your Hazard Data and Information Via the Internet: Turn Up the HEAT!

Many organizations around the world work on issues related to coastal hazards. Knowing where to go to find relevant hazard-risk information for your community can be a difficult task.

In response to this problem, the NOAA Pacific Services Center created the Hazard Education and Awareness Tool (HEAT)—an innovative, no-cost tool that brings this information to one location and helps prepare communities for natural disasters.

HEAT merges Google Maps technology with spatial-hazards data to display detailed maps of hazard risks, and provide local information on hazard awareness, in an easy-to-use template format. Simply type an address into the search boxes and find out instantly whether it is located in a hazard-risk zone.

Hawaii is the current pilot site for this interactive, natural-disaster preparedness tool. The Hawaii Tsunami Hazard Information Service was developed using the HEAT template to address tsunami risk throughout the state.

The service allows Hawaii residents and visitors to search an address or island area. The address search returns an interactive tsunami-risk map, along with information on emergency planning, disaster response and preparedness kits, Hawaii's tsunami-warning system, when to evacuate, and more.

The HEAT template is available to any organization—all that is needed is hazard-map data, a basic Web server, and free Web-mapping software.

Moreover, the tool's search functionality can be readily distributed to other local disaster management agencies and integrated within their websites—thereby providing multiple locations where users can access this "one-stop shop" for hazards information.

See how Hawaii is applying the HEAT template—visit *www.csc.noaa.gov/psc/tsunami/*. To find out more about HEAT and how it can be used in your community, contact *Russell.Jackson@noaa.gov*. ❖

Grant Opportunity

Ocean and Human Health Initiative
www.csc.noaa.gov/funding/
Deadline: November 15, 2007
Grants Available: 7 to 14 grants or cooperative agreements
Available funds: $1,000,000 to $5,000,000
Award range: $100,000 to $1,000,000

Eligible applicants: state and local agencies, academic institutions, nonprofit organizations, and for-profit organizations. Funded projects will explore links between human and ocean health in one of two possible areas: early warning systems for human health risk and methods to minimize seafood contamination.

Information Resources

Harmful Algal Bloom Forecasting System
www.csc.noaa.gov/crs/habf/
This site provides information about the location, extent, and potential impact of harmful algal blooms (HABs) in the Gulf of Mexico. Conditions are posted twice a week during the HAB season.

Southeast Coastal Climate
www.coastalclimate.org
This site provides information for recreational and commercial fisheries and other coastal interests. Data topics include tides, El Niño or La Niña, marina data, and hurricanes. The website was developed by the University of Georgia and Florida State University through a contract with the NOAA Coastal Services Center.

TAKING OUT A PARKING LOT TO Improve Water Quality in Indiana

There have been songs about paving over paradise to put up a parking lot. In Indiana, they took out a parking lot and restored a natural area with a goal of improving water quality in an adjacent swimming beach. The fact that the area is turning into a paradise of native plants surrounding a meandering creek with burgeoning fish and birds is almost a bonus.

"To the best of our knowledge," says Mike Molnar, program manager for the Lake Michigan Coastal Program in the Indiana Department of Natural Resources, "this is the first time a creek has been daylighted in a dune environment."

Daylighting refers to restoring a portion of the creek's natural ecosystem and exposing the water to sunlight, helping to lower *E. coli* levels.

In addition to its environmental and habitat benefits, the award-winning project is being used for outreach and education for beachgoers and homeowners.

Built to Last

The parking lot was constructed in the late 1920s by the Civilian Conservation Corps (CCC). "The first photo of it we have is circa 1930, and on top of the parking lot are the CCC barracks," notes Molnar.

Before paving the lot, which was used soon after its construction to provide auxiliary parking for visitors to beaches at Indiana Dunes State Park, the CCC routed a 1,300-foot section of Dunes Creek through an 84-inch diameter concrete and steel pipe.

"It was built to last," quips Molnar.

Beach Closed

In recent years, swimming beaches at the park, located in northwestern Indiana on the shore of Lake Michigan, often had to be closed because of high bacteria levels.

It was determined the parking lot was contributing to high levels of *E. coli*.

"In the Dunes Creek watershed," explains Joe Exl, coastal nonpoint coordinator for the Lake Michigan Coastal Program, "the soil types are unsuitable for septic tank systems, but older homes don't have access to sewers. We found out that about 40 percent of the septic systems are in a state of failure. That's a major contributing factor [to the closures], as well as the fact that there's a lot of natural *E. coli* in the watershed."

Exl adds, "Sediment and excessive nutrients also are coming from a variety of sources, including home construction, agriculture, and erosion."

Dunes Creek being routed through a culvert eliminated the natural filtering effects of the stream.

"When it was culverted, it became like a giant petri dish," says Molnar. "It created a dark, warm environment that *E. coli* likes."

Obstacles

The idea for the project had been around since 2003, says Molnar. "At that time, Dunes State Park was reworking its campground facility and other infrastructure in an attempt to reduce impacts on the environment."

The parking lot only served its purpose once or twice a year and was in disrepair.

"It just made sense that this seldom-used area could be used to do some good ecological restoration," Molnar explains. "This was one of the projects discussed at the time, but it was a big ticket item, and the state being the state didn't have a lot of extra cash lying around."

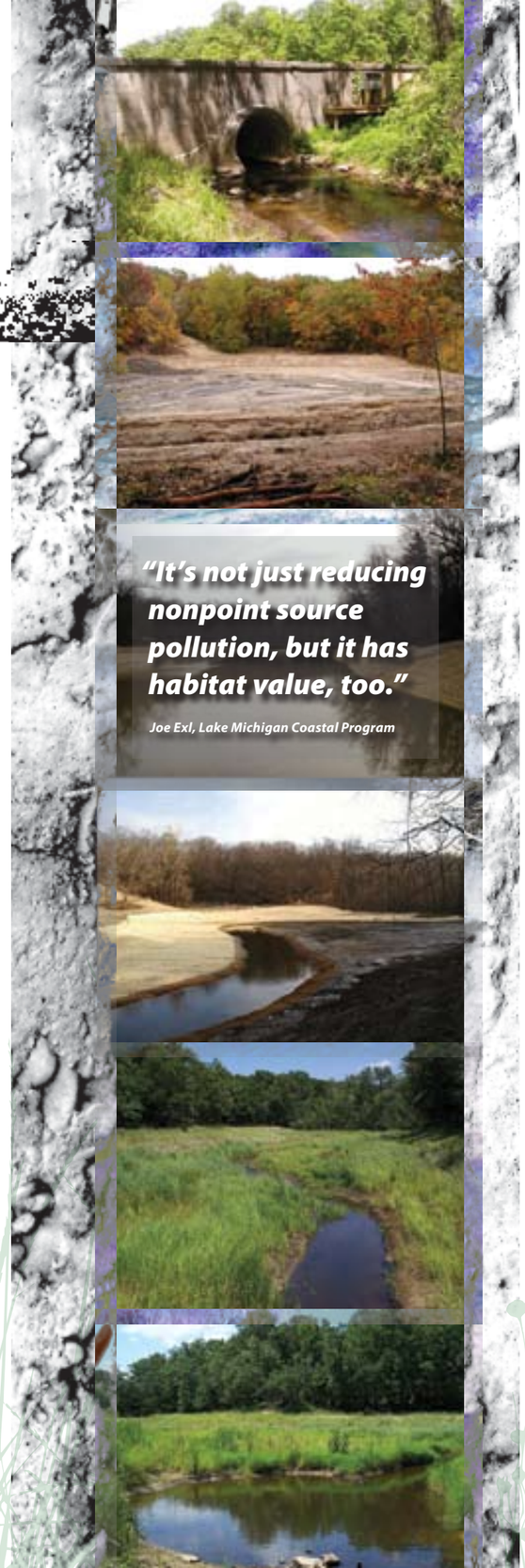
Because the parking lot was situated between two large dunes, engineers also had worries that if the lot were removed, it would destabilize the system.

In 2004, two private firms were hired to evaluate the feasibility of the project. After a green light, and a grant from the National Oceanic and Atmospheric Administration, the project was begun in 2005.

Just a Phase

The project was broken into three phases: a design phase; the actual removal of the lot and culvert, and rough grading work; and the final grading and planting.

A little over two-and-a-half acres of concrete had to be broken up and removed, Molnar says. Removing the reinforced steel and concrete culvert turned out to be much more onerous than the contractors had anticipated.



Photos courtesy of Lake Michigan Coastal Program

While the removal work was done, the stream was temporarily rerouted. A new meandering channel was constructed along the stream's original path, and the floodplain was restored to hold water during heavy rains.

When work was completed in spring of 2006, the area was planted with a mix of native plants and seeds.

The total cost of the project was almost $700,000, with $425,000 coming from federal coastal zone funds.

Life Returns

Since constructed wetlands require one to three years for the ecosystem to become functional, it is too early to tell the amount of *E. coli* the restoration will ultimately remove, but water quality testing is already showing signs of improvement, says Exl.

Fish, including reproducing trout and salmon, and birdlife have returned to the creek. Within the floodplain, fine silts and sediments have been deposited, indicating that sediment reduction is occurring.

"It's already helping," says Exl. "It's evident when you look at the site. It's not just reducing nonpoint source pollution, but it has habitat value, too."

A bonus of the project has been education of beachgoers and outreach to homeowners on the importance of septic system maintenance and preserving natural areas.

Recognition

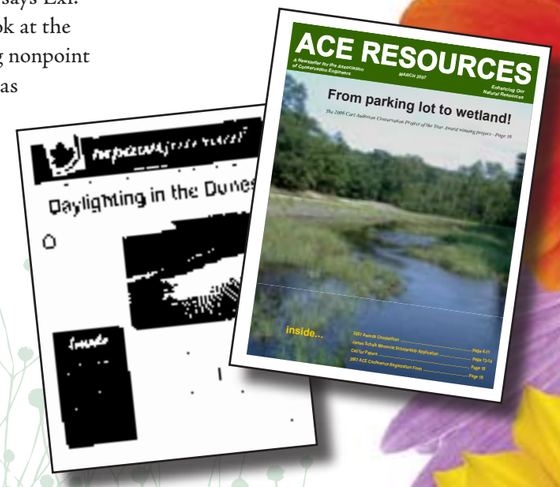
Because of the uniqueness and success of the project, the Indiana Department of Natural Resources received a Carl Anderson Conservation Project of the Year award from the Association of Conservation Engineers (ACE) in 2006.

The project also has been nominated for the 2007 Governor's Awards for Environmental Excellence in Indiana.

The best reward for Molnar, however, was seeing the project through to fruition.

"The big thing I learned," he says, "is that nothing is impossible. Bureaucratically, nothing is impossible." ❖

For more information on the Dunes Creek daylighting project, contact Mike Molnar at (317) 233-0132, or mmolnar@dnr.in.gov. You may also contact Joe Exl at (219) 921-0863, or jexl@dnr.in.gov.



A series of photos showing before, during, and after the Dunes Creek daylighting project.

CORAL BLEACHING:

THE IMPACT OF RISING SEA TEMPERATURES ON FLORIDA KEYS' REEFS

At the end of July, coastal resource managers in the Florida Keys were reporting that isolated coral colonies were beginning to show signs of paling or partial bleaching. If conditions continued, the threat of mass coral bleaching would be high.

"We're ramping up for a bleaching year."

Dave Score, Florida Keys National Marine Sanctuary

Widespread coral bleaching means that these normally colorful ecosystems are being subjected to starvation and could face disease, and even death. The primary culprit, scientists say, is rising sea temperatures fueled by climate change.

The consequences of major bleaching events could include millions of dollars in lost tourism revenue, communities left more vulnerable to coastal storms, and less seafood for people around the country to eat.

"Based on observations in the Florida Keys, it is clear that coral bleaching events have been intensifying over the past two-and-a-half decades on a local scale. This is consistent with other observations reported on regional and global scales," says Billy Causey, regional director of the Southeast Atlantic, Gulf of Mexico, and Caribbean Region of the National Oceanic and Atmospheric Administration's (NOAA) National Marine Sanctuary Program.

While coastal resource managers cannot address the global rise in sea temperatures, Causey and others say there are things resource managers can do to help improve corals' chances of survival, such as reducing nonpoint source pollution and other coral stressors, conducting baseline monitoring of corals and other ecosystems, identifying and protecting resilient reefs, and communicating with managers, scientists, and the public.

This advice is suggested not only for managers of states or territories with coral reefs off their shores, but also for all environmental managers who may not realize the impact their state or local storm runoff may be having on coral reefs.

Florida managers also warn that corals are one of the first indicators of ecosystem change related to climate change and that the lessons they are learning are a warning to other managers who should be preparing now for the potential of environmental impacts.

Benefits of Coral Reefs

The Florida Keys receive about four million visitors a year, who spend more than $1 billion. Many of these visitors come to scuba dive, snorkel, and sport fish—activities that are all dependent on healthy reefs.

The reefs provide habitat for finfish and shellfish, helping commercial fishermen in the Keys land $50 to $70 million worth of seafood every year. Coral reefs absorb constant wave energy from the ocean, protecting coastlines from increased storm damage, erosion, and flooding.

The U.S. and world economies also benefit from coral reefs, says Mark Eakin, coordinator of NOAA's Coral Reef Watch.

About 45 million tourists visit U.S. coral reefs every year, generating $17 billion in income, and U.S. reefs generate $247 million from commercial fishing. Globally, coral reefs have a value of $375 billion and provide food to about one billion people in Asia alone.

Photo by Wolcott Henry and courtesy of the Marine Photobank

Getting Warmer

"The biggest issue we're seeing in global climate is that ocean temperatures are rising, and we expect them to continue to rise in the future," says Eakin. "Corals are sensitive to extremes in water temperatures and are already living at their uppermost thermal limits."

Less than a two-degree Fahrenheit temperature increase can trigger a major bleaching event.

"Coral bleaching can be caused by many adverse environmental conditions, but unusually high sea temperatures have been found to be the primary driving factor in mass coral bleaching events where entire reef systems and regions bleach," says Derek Manzello, marine biologist with the Cooperative Institute for Marine and Atmospheric Studies at the University of Miami.

"Without a doubt, in the late 1970s and early 1980s we started seeing signals of elevated sea surface temperatures affecting coral reefs in the Keys," says Causey. "We're already in a situation where the water temperature has risen high enough that we're seeing bleaching events occurring with greater frequency and intensity."

Bleaching

Corals often respond to stress by expelling the colorful algae that live within their otherwise clear tissues. Because these algae give corals their color, bleached colonies often appear stark white.

"If it's a mild event, coral will regain algae, and they will recover," Eakin explains. "If it is severe, or if the event is long-lasting, corals will die."

Secondary impacts to corals from bleaching events include disease, loss of living tissue, and low recruitment.

Manzello points out that "nearly every reef in the world has undergone temperature-related bleaching, and the increase in the frequency and severity of coral bleaching events over the past 25 years is unprecedented."

Ramping Up

In 1997 and 1998, coral reefs worldwide bleached for the first time, killing about 16 percent of the world's living coral reefs.

Since 1996, more than 35 percent of the Florida Keys' shallow coral reefs have died. The number of coral species within particular reef areas is declining as well, says Brian Keller, science coordinator at the Florida Keys National Marine Sanctuary.

The risk of mass bleaching is higher when weather forecasts call for high air temperatures and extended periods of low winds and low cloud cover. In 2005, the Florida Keys escaped the impacts of a Caribbean-wide bleaching event when four hurricanes churned past the area, lowering water temperatures.

"We're ramping up for a bleaching year," notes Dave Score, superintendent of the Florida Keys sanctuary. "We're seeing higher temperatures in mid-July than we did last year."

Scientists monitor corals during bleaching events.

Vulnerability

Coral reefs typically cannot withstand continued exposure to sea temperatures colder than 68 degrees Fahrenheit or warmer than 86 degrees, or great changes in water quality or salinity.

"Here in the Keys, the reefs that are the most vulnerable to bleaching are the ones that are the most popular—the shallow reefs that are the most beautiful dive destinations," says Causey.

Nearshore patch reefs have shown the least amount of decline. "One might not expect that to happen," notes Causey, because these reefs are generally found in

Continued

Photo by Diana Schmitt and courtesy of the University of Miami

ADDITIONAL INFORMATION

- A Reef Manager's Guide to Coral Bleaching, *www.coris.noaa.gov/activities/reef_managers_guide/*
- The National Oceanic and Atmospheric Administration (NOAA) Coral Reef Conservation Program, *www.coralreef.noaa.gov*
- NOAA's Coral Reef Watch, *http://coralreefwatch.noaa.gov*
- NOAA's Coral Reef Information System (CoRIS), *www.coris.noaa.gov*
- The Florida Keys BleachWatch program, *http://isurus.mote.org/Keys/bleachwatch.phtml*
- The Florida Reef Resilience Program, *www.nature.org/wherewework/northamerica/states/florida/preserves/art17499.html*

Florida Keys' pillar coral and porous sea rod during the 2005 bleaching event.

the most turbid waters in the Keys adjacent to the shoreline where sanctuary monitoring has found high levels of nutrients. They are also exposed to a wider temperature range than the other reefs.

"They have acclimated over a long geological time to a broader range of temperature shifts," Causey explains. "The algae in patch reefs also are a different type, which helps the coral communities survive."

Corals are able to adapt, says Eakin, "if the rates of change are going extremely slowly. We don't know how slow that is. The problem that we're running into now is that the changes we're seeing are at a rate that far exceeds what corals are capable of responding to."

Stressed Out

One of the problems is that the corals may be facing too many other stressors at once, such as land-based sources of pollution, habitat loss and degradation, and overfishing.

"Under normal conditions, corals can tolerate a certain level of environmental stress," says Causey. "If you add the temperature stress to the corals and you add any of the other stressors—whether it is nutrients or physical impacts—all of these are part of the multiple stressors that are pushing corals to the very brink."

The good news is that coastal resource managers can play a critical role in responding to bleaching events and in helping to control the issues that put additional stress on reefs.

Building Relationships

Some of the successful management efforts undertaken by the sanctuary include creating no-impact zones that protect reefs and species, and providing *in situ* and remote sensing observations to researchers who have developed prediction methods and who are working to better understand the bleaching phenomenon.

Sanctuary staff members have reached out to other reef managers and scientists around the country and world to share and compare bleaching-related information and insights, and contributed to *A Reef Manager's Guide to Coral Bleaching*, produced by NOAA, the Great Barrier Reef Marine Park Authority, and others, that provides information on actions local reef managers can take.

When a bleaching event is predicted, sanctuary managers alert the local dive and fishing communities, who provide information on bleaching conditions to an early-warning network of volunteers called BleachWatch.

They are also collaborating with resource managers, researchers, nonprofits, and other stakeholders to help develop strategies to support the natural resilience of reefs.

Stress Management

Other management actions that could improve reef health include working to improve water quality, or timing impacts to avoid exacerbating bleaching events. Mitigating the impacts of coastal development, commercial fishing, agriculture, and tourism could also reduce sources of coral stress.

"These are things coastal managers are looking to do anyway, and in many cases aren't doing as well as they would like because of factors beyond their control," Eakin says. "What's going on with coral reefs could serve as a catalyst to help them to take the actions they would already like to be taking."

He adds, "This truly is their issue, whether they have a reef in their backyard or not. Two-thirds of the U.S. has an influence on the reefs in the Gulf of Mexico and Florida Keys."

Harbingers

Coastal managers may also want to take the coral bleaching events in the Florida Keys as forewarning to

Continued on Page 9

Photos by Marilyn Brandt and courtesy of the University of Miami

Website Helps Build Planning Capacity of Connecticut Communities

The first step of a community planning process is creating an inventory of the town's natural, cultural, and economic resources. The problem typically encountered by local planners is not a lack of information for the inventory, but information overload. Factor in limited experience with geographic information systems (GIS), and the planning process can easily get sidetracked or derailed.

> *"You can plug into the site at your level of sophistication."*
>
> *John Rozum, Connecticut Nonpoint Education for Municipal Officials*

Resource managers in Connecticut recently launched a website enabling citizens and land use decision makers to easily access statewide natural resource data and maps.

"We've been giving workshops on resource inventories for years," says John Rozum, director of the Connecticut Nonpoint Education for Municipal Officials (NEMO) program, "but have found that getting access to mapping data is a real stumbling block. With the new website, local land use planners don't need any technical know-how to get started."

The site, the Community Resource Inventory (CRI) Online (*http://nemo.uconn.edu/tools/cri/*), lets visitors create a series of key resource maps for any of the state's 169 municipalities. The maps include water resources, land cover, protected open space, and wetland and farmland soils, in addition to information such as roads and utility service areas.

"What's innovative about the site," says Rozum, "is that it's meant for people with varying capabilities in terms of geospatial technology and use. You can plug into the site at your level of sophistication."

For instance, nontechnical users can view the map series for their town, while GIS users can link their desktop GIS to the site.

The website was developed by NEMO, which is part of the University of Connecticut's Center for Land Use Education and Research. Data for the website's maps came from the university and the Connecticut Department of Environmental Protection, which also provided a $35,000 grant for the site's development.

While the website was only unveiled in January, the University of New Hampshire/National Oceanic and Atmospheric Administration's (NOAA) Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET) has funded the National NEMO Network to produce a guide to help three states produce similar sites.

Part of the challenge of developing the site, Rozum says, was parsing out the data critical for planning purposes. "We came up with seven or eight map sets that were key to making decisions." The project team also decided to exclude data that were not available for the entire state.

Feedback about the site indicates that, in addition to town planners, members of the public are using the data layers.

"It's democratized the information," Rozum says. "The information is in the hands of the professionals and the people going to public hearings. This way, everyone is looking at the same information, and it informs the debate a little better."

He adds, "We're pretty pleased with it. It's filled a niche that was desperately needed." ❖

To view the Community Resource Inventory (CRI) Online, point your browser to http://nemo.uconn.edu/tools/cri/. For more information, you may contact John Rozum at (860) 345-5225, or john.rozum@uconn.edu.

Image courtesy of the National NEMO Network

Nothing Fishy about Success of California Seafood Website

With frequent media reports on everything from the safety of seafood from China to concerns about mercury in fish to the amazing health benefits of seafood, it's understandable that consumers can be confused by the mixed messages. The seafood industry, too, must stay on top of the latest information, as well as safety and quality regulations.

The website receives more than 1,000 visitors a day.

The place where both industry and consumers can turn to find the latest, best, and most comprehensive information on seafood safety and quality is the Seafood Network Information Center, or SeafoodNIC, a website hosted by California Sea Grant's Seafood Extension Program.

"We know there is confusion out there," says Pamela Tom, director of SeafoodNIC. "We're frustrated by it and want to get a uniform message across about the benefits and risk. Consumers need sound, science-based information to help them select what fish to eat."

SeafoodNIC is an Internet portal that provides extensive information on national and international importing and processing regulations. It features hundreds of files and links to seafood resources at universities and more than 50 national and international agencies and organizations.

Trainers and educators in seafood safety access key resources on the site, as well as information on seafood nutrition, food labeling, and potential contaminants. The information offered to consumers includes advice on how to spot a safe seafood seller and how to properly prepare and store seafood. It even provides links to recipes.

The website, *http://seafood.ucdavis.edu*, receives more than 1,000 visitors a day and is used by seafood processors, distributors, importers, inspectors, retailers, analytical laboratories, teachers, researchers, and consumers.

SeafoodNIC was the brainchild of the late Robert J. Price, who retired as the leader of California Sea Grant's seafood technology unit and who was a mentor to Tom.

"I inherited the site after he retired," Tom recalls.

The site was designed to assist the seafood industry and regulators in implementing the U.S. Food and Drug Administration's 1995 Seafood Hazard Analysis and Critical Control Point (HACCP) regulation, which ensures the marketing of safe seafood in the U.S.

The first version of SeafoodNIC began in 1995 and predated the World Wide Web. It evolved to the Web version in 1997.

Pamela Tom, director of SeafoodNIC, works with partners like Donald Karmer of Alaska Sea Grant to provide outreach about seafood.

Along with the website, Tom manages two Internet mailing lists—the Seafood HACCP discussion list and the California Seafood Industry Outreach list.

In 2005, Tom was recognized as "technologist of the biennium" by the International Association of Fish Inspectors for utilizing the Internet as an outreach tool to communicate seafood safety and quality information.

"We're very pleased to be able to provide this service," Tom says. "It's received worldwide recognition, and people rely on the site for information."

She adds, "This is a wonderful resource for the seafood community." ❖

To view the Seafood Network Information Center, point your browser to http://seafood.ucdavis.edu. For more information, contact Pamela Tom at (530) 752-3837, or pdtom@ucdavis.edu.

Photo by Sally Soileau and courtesy of California Sea Grant Extension

Continued from Page 6

prepare for their own environmental impacts from climate change.

"It's a matter of time before others are experiencing the impacts of climate change like we're experiencing in the Keys and other areas," says Causey. "Coral reefs are really good indicators of climate change and truly are also an indicator of ecosystem change. . . They are the canaries in the coal mine."

He adds, "One of the lessons that we've learned is the need to focus scientific efforts on understanding this change as it takes place, and being prepared to adapt management for the future."

Staying Positive

While the impacts of coral bleaching are grave, there is still hope.

"It's very serious in the short term, but over a much longer term coral reefs have adapted in various ways," says Eakin. "Coral reefs have been around for 400 million years, and corals will continue to be around in some form."

"We're not giving up," says Score, "and the colleges in South Florida are not giving up, and I don't want to send the message that the problem is too big to fix."

He adds, "Don't be afraid to do your part when it feels like you can't fix it all. It takes all of us working together to buy the time we need until we have a global solution." ❖

For more information on coral bleaching, contact Billy Causey at (305) 809-4670, ext. 234, or Billy.Causey@noaa.gov. Contact Dave Score at (305) 809-4700, or David.A.Score@noaa.gov, or Brian Keller at (727) 553-1100, or Brian.Keller@noaa.gov. Mark Eakin can be reached at (301) 713-2857, ext. 109, or Mark.Eakin@noaa.gov.

TSUNAMI TOOL

HAWAII TSUNAMI HAZARD INFORMATION SERVICE

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- *Tsunami awareness information*
- *Personal emergency plans*

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