

COASTAL SERVICES

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LINKING PEOPLE, INFORMATION, AND TECHNOLOGY

THE RISING TIDE: How Rhode Island Is Addressing Sea Level Rise

**Ensuring the Right Kind
of Sand Goes on North
Carolina Beaches**

**Taking California Sanctuary's
Bait to Learn about Sharks**



FROM THE DIRECTOR

It's hard to visualize a sea level rise of 2 feet by 2100, which the Intergovernmental Panel on Climate Change (IPCC) projected last year.

Easier to envision are the potential impacts of sea level rise on coastal areas, such as residential and commercial structures and infrastructure becoming more vulnerable to flooding and storm damage, existing seawalls and revetments that were designed for historically lower water levels losing their effectiveness, and beaches and wetlands becoming more vulnerable to erosion.

Even more seriously, relative sea level rise resulting from climate change could compromise drinking water and displace coastal populations.

While scientific certainties are slow in coming, Rhode Island and other states are moving forward now with policies and planning to help make their coastal areas more resilient to sea level rise and other natural hazards.

The cover story of this edition of *Coastal Services* looks at Rhode Island coastal resource managers' efforts to prepare for 3 to 5 feet of sea level rise, including working with the legislature to amend the state building codes and developing related coastal regulations to explicitly address sea level rise and climate change.

As part of the regulatory creation process, Rhode Island Sea Grant

worked with the National Oceanic and Atmospheric Administration (NOAA) Office of Ocean and Coastal Resource Management to create a summary of sea level rise initiatives of coastal programs across the nation—a document that could be of value to every coastal state. (To view this document, point your browser to http://seagrant.gso.uri.edu/ccd/slr/SLR_policies_summary_Mar6_final.pdf.)

In this edition, you can read about North Carolina coastal managers' efforts to develop criteria for the sand placed on beaches during the nourishment process—that state's only viable tool to address erosion issues.

We also feature an article on Ohio's Watershed Coordinator Grant Program, which provides funding and support for local governments, nonprofits, and other organizations to hire a staff person to develop and implement watershed action plans. Their plans include 6217 Coastal Nonpoint Program management measures, despite federal funding fluctuations.

As always, we hope you find all the articles in this edition interesting and informative.

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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NEWS AND NOTES

Simplifying Coastal Digital Elevation Models

A high-accuracy, seamless elevation model is essential to understanding where water will flow during events such as sea level rise, hurricane flooding, tsunami inundation, and inland flooding. A topobathy digital elevation model combines land elevation with seafloor data to make one continuous surface.

The National Oceanic and Atmospheric Administration developed "A Roadmap to a Seamless Topobathy Surface," an on-line resource for constructing digital elevation models. The website provides on-line maps of existing data, documents to assist in data manipulation, and soon, application examples.

Resources within the website include the following.

Data Inventory

The first data inventory available on the website is topography and bathymetry for the Gulf of Mexico. The location, collection date, owner, and other information about each data set are provided through maps, resulting in a data "snapshot" as of November 15, 2007. New inventories will be added as they become available, with the next data coming from the southeastern region of the U.S. (Florida to Maryland).

Process Considerations

This portion of the site strives to improve and streamline the process of creating digital elevation models by providing an overview of datum conversion and integration techniques. The section stresses the importance of establishing a uniform reference for multiple data sets and describes techniques for manipulating and joining these sets.

Topobathy Applications

The third part of the website is nearing completion. This section will highlight coastal applications that can benefit from the use of digital elevation models.

To view "A Roadmap to a Seamless Topobathy Surface," point your browser to www.csc.noaa.gov/topobathy/.

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Shifting Sand:

Ensuring the Right Kind of Sediment Goes on North Carolina Beaches

When shell hash and cobblestones showed up on two North Carolina beaches that were being nourished with sand, coastal resource managers in that state knew they had a regulatory problem.

“We knew we needed to do a better job of defining ‘compatible sediment,’” says Jeff Warren, coastal hazards specialist with the North Carolina Division of Coastal Management. Sand that is used for nourishment or beach-fill projects needs to “mimic the native characteristics of North Carolina’s beaches.”

Starting with only two sentences in existing rules that defined compatible sediment, the coastal division spent three years working with a panel of scientists reviewing data and talking with stakeholders to develop sediment criteria regulations for the state—regulations that they believe to be the most comprehensive in the country.

“We went from two sentences to four pages of ruling,” Warren says. Although controversial in early stakeholder discussions, when the rule was finally brought forward for a public hearing and approval, “there was little opposition.”

The rule-making process worked so well that Warren intends to use it “as a model for developing new technical rules and getting them through the public process.”

Shifting Sands

Erosion is experienced by nearly 70 percent of beaches worldwide. On the East Coast of the U.S., the number of beaches experiencing erosion is closer to 80 percent.

Beach nourishment, also known as beach fill, is the practice of placing sand on a beach to combat erosion. Another option is using “hard” oceanfront structures, such as seawalls and groins—an option prohibited by North Carolina state law.

“Since we don’t allow hardened structures, that gives us two options for mitigating coastal erosion—dismantle and retreat, or soft protection” using sand to nourish beaches, Warren says. “If you make the beach-fill criteria too tight, or make it too expensive to find sand and run the necessary analysis, then beach fill is no longer a feasible option.”

“We had to walk that narrow line,” he says, “of protecting the beaches but not taking the beach-fill option off the table.”

Not Following the Rules

In 2001, coarse sediment made up of broken pieces of shells was placed on the beach at Bogue Banks, and the following year, 6- to 8-inch rocks were mixed in with sand being placed on the beach at Oak Island.

“It really made us look at our rules to ensure that there were

“Anytime you start proposing new rules, everyone is always anxious about what you are going to come up with.”

*Steve Underwood,
North Carolina Division
of Coastal Management*

adequate controls for matching sediment coming from another area to what was being placed on a beach,” says Steve Underwood, assistant director for policy and planning with the North Carolina Division of Coastal Management.

Warren adds, “The pre-existing rule basically said, ‘any material put on a beach must be compatible with that beach to create as minimum an adverse impact as possible.’ We realized that was far too subjective and better guidelines could be developed.”

Science-Based

The coastal division worked with a group of coastal geologists and engineers who make up the North Carolina Coastal Resources Commission’s Science Panel on Coastal Hazards to develop recommendations.



Over two years, the panel and division staff members looked at industry standards, reviewed technical data and other states’ sediment compatibility guidelines, and studied the native sediment characteristics of North Carolina beaches.

Amid the panel’s review—and seeming to emphasize the importance of its work—a third nourishment project left mud balls on a beach.

Better Than Nothing?

While the science panel conducted its review, the division also began extensive outreach efforts.

Warren notes that while most residents on Bogue Banks and Oak Island weren’t happy with the shell hash and stones, “there were an awful lot of people who thought it was better than not getting any beach fill at all.”

“Different groups of stakeholders had different interpretations of whether these were bad projects or not,” Underwood says. “Anytime you start proposing new rules, everyone is always anxious about what you are going to come up with.”

To help address concerns, the division talked with residents, local governments, nonprofit organizations, and private industry. In addition to planned public

meetings, a website, distributed surveys, and many face-to-face meetings were used to explain the process and science, and to get public feedback. “I talked with everyone who would listen,” Warren says.

Test Drive

The division took the additional step, Underwood says, of using the proposed regulations to review past projects. “We test-drove these rules to make sure the good projects would have been allowed and projects that were less desirable wouldn’t have occurred.”

“No rule is perfect,” Warren adds, “but the new standards will increase the confidence that borrow material is similar to the native beach.”

Defining Compatible

The new rule, which went into effect February 1, 2007, provides an objective definition of sediment compatibility for beach-fill projects, limiting excessively fine sediments, such as silt and clay, and coarse sediments, such as gravel

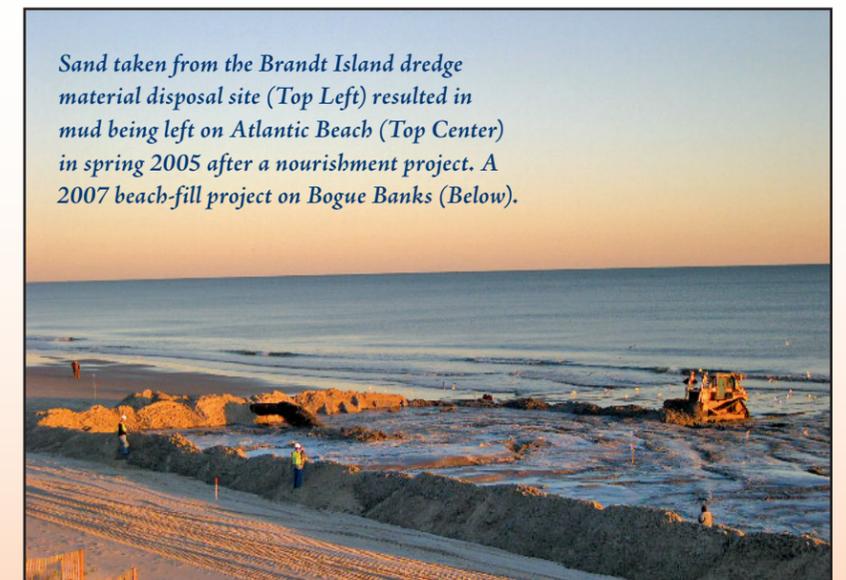
and cobblestones. It also outlines specific protocols for sampling both the beach that will receive nourishment and the site from where the sand will be taken.

Warren notes that they have already made a clarifying adjustment to the regulations. “This is a living document and is continuing to evolve. We want to make sure it works.”

He adds, “I am anxious for others to use our criteria as a template and provide a critical review. Could they be made better? If so, how?”

“We’re proud of our sediment criteria,” Warren says. “However, we’re always open for improvement and appreciate the opportunity for peer review.” ❖

For more information on North Carolina’s sediment criteria regulations, point your browser to www.nccoastalmanagement.net/sediment.htm. You may contact Steve Underwood at (919) 733-2293, ext. 224, or Steve.Underwood@ncmail.net, or Jeff Warren at (919) 733-2293, ext. 241, or Jeff.Warren@ncmail.net.



Sand taken from the Brandt Island dredge material disposal site (Top Left) resulted in mud being left on Atlantic Beach (Top Center) in spring 2005 after a nourishment project. A 2007 beach-fill project on Bogue Banks (Below).

The Rising Tide:

How Rhode Island Is Addressing Sea Level Rise

Visualizations created by Rhode Island Sea Grant show current tide levels, 3 feet of sea level rise, and 3 feet of sea level rise with spring tides.



PHOTOS COURTESY OF RHODE ISLAND SEA GRANT

While a United Nations panel of scientists and government officials is predicting that oceans will rise up to 2 feet by 2100, coastal resource managers in Rhode Island are preparing for the sea to rise 3 to 5 feet. And that estimate is considered conservative.

“It’s a big issue—a major issue—for us,” says Grover Fugate, executive director of the Rhode Island Coastal Resources Management Council. “We’re already starting to see issues in terms of our waterfront and water level impacts.”

Sea level rise along Rhode Island’s coast is contributing to increased coastal flooding and erosion, and has the potential to damage infrastructure and property.

When it became clear that sea level rise resulting from climate change would accentuate the impacts of future storms on coastal resources, the coastal council and

Rhode Island Sea Grant worked with the legislature to amend the state building code to explicitly address sea level rise and climate change. They then began developing related coastal regulations, which were adopted in January.

These regulations not only explain the science of Rhode Island’s sea level rise and provide historical data, but they also will help the coastal council and others in the state better manage development and related concerns.

“Considering sea level rise when assessing appropriately placed development will be a vital tool for the coastal council, as well as municipalities, their planners, and developers,” says Fugate. “Having these regulations in place will allow us to determine which areas would be most susceptible to flooding, and to plan accordingly for the future.”

Another result of the regulatory creation process is a summary of sea level rise initiatives of coastal programs across the nation.

Rising Tides

Sea level rise refers to the change in mean sea level over time in response to global climate and local changes. The Intergovernmental Panel on Climate Change (IPCC) projected last year that the world’s oceans would rise from 7 to 23 inches in the coming century. Since 1990, sea level has been rising faster than the rate predicted by models used to generate earlier IPCC estimates.

Future sea level rise is not expected to be globally uniform or linear, notes Pam Rubinoff, coastal management extension specialist for Rhode Island Sea Grant. As a result of ice flow dynamics or local subsidence, some regions will experience higher water levels than the global average, and others will be less impacted.

In addition to rising global sea levels, the land surface in Rhode Island is subsiding at a rate of approximately 6 inches per century, according to a coastal council science report. “The combination of these two effects is evident from the long-term trend recorded by the Newport tide gauge, which indicates a rate of 10.1 inches (plus or minus 1.2 inches) of relative sea level rise over the last century.”

Fugate notes, “The acceleration data is lining up on our worst case scenario line, which has us very concerned.”

“The acceleration data is lining up on our worst case scenario line, which has us very concerned.”

*Grover Fugate,
Rhode Island Coastal Resources
Management Council*

Looking for Proof

Rhode Island began to suspect impacts from sea level rise after reports of regular flooding of a waterfront park in the City of Providence. “The city is using its hurricane gates 19 days of the year when there are high tides and wind,” Rubinoff explains. “When you start having that happen, you begin to ask the question.”

The flooding was particularly troublesome to the state’s coastal managers because there is \$4 billion in development on the waterfronts in Providence, East Providence, and Pawtucket.

“There was a heightened sense that we need to look at this and see what the implications were for us,” Fugate says. “We knew that all this development would be susceptible to storm damage, and we wanted to get ahead of the curve on that before we were dealing with an after-the-fact issue.”

As part of the development of a Special Area Management Plan (SAMP) in 2006, the coastal council, Sea Grant, and others began to look into the causes of the flooding.

The tide charts showing an increase of almost a foot since 1929 seemed to be the proof that sea level rise was the culprit. Other incriminating evidence included erosion rates that doubled from 1990 to 2006 in certain areas, wetlands that were transitioning to salt marsh, and a three-degree rise in water temperature since 1970.

Feeling Vulnerable

This evidence was not welcome news. In addition to the potential of making recreation areas, public spaces, and coastal wetlands more vulnerable to flooding, storm damage, and erosion, sea level rise is projected globally to make residential and commercial structures, roads, and bridges more vulnerable, and to reduce the effectiveness and integrity of existing seawalls and revetments that were designed for historically lower water levels.

Drinking water may be compromised from salt intruding into aquifers. Higher water levels could compromise wastewater treatment facilities, and future increases in relative sea level could displace coastal populations.

There are also concerns about species changes. In Rhode Island,

there are projections that the lobster fishery could disappear over the next two decades, and there are already declines in winter flounder populations, which may not be due to overfishing, Fugate says.

Policy Window

Coastal hazards—including sea level rise—were being addressed by the SAMP planning group, which was working to update the Metro Bay SAMP that was originally created in 1983, says Rubinoff.

At the same time, a state legislative committee was looking at insurance issues related to hurricanes.

“We don’t get hurricanes that often, but this was post-Katrina and post-tsunami,” Rubinoff says. “The whole state of Rhode Island is in the coastal zone, so we looked at this as a potential policy window.”

The sea level rise data were presented to senate policy staff members, who were looking at the concerns of the insurance companies regarding building codes.

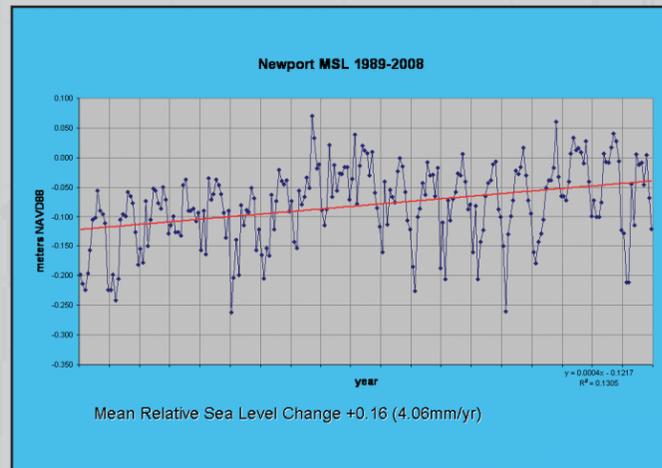
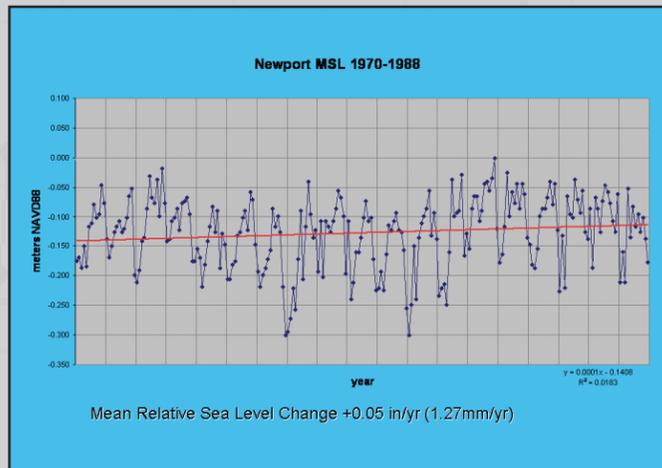
In December 2006, the Rhode Island legislature passed a law authorizing the council to “develop and adopt policies and regulations necessary to manage the coastal resources of the state and protect life and property from coastal hazards resulting from projected sea level rise and probable increased

Continued



Historic photos of Rhode Island storm damage.

PHOTOS COURTESY OF RHODE ISLAND COASTAL RESOURCES MANAGEMENT COUNCIL



frequency and intensity of coastal storms due to climate change.” The council was also authorized to collaborate with the state building commissioner to adopt freeboard calculations, or the elevation of structures above the flood zone.

Examining the Issues

In order to incorporate sea level rise and other climate change considerations into siting, building standards criteria, and enforceable policies, the coastal council and Sea Grant first focused on the science.

Scientists from the University of Rhode Island “looked into the science of what sea level rise is and what the existing science says,” explains Rubinoff. In addition, the coastal council and Sea Grant “looked at existing development issues, identified key priorities, and looked at the impacts on buildings, the shoreline, and habitat.”

A series of public meetings were held. Fugate says visualizations created by Sea Grant showing popular coastal locations with three feet of sea level rise “really got people’s attention and helped people understand the issues.”

The Big Picture

Sea Grant also looked at what other states were doing, working with the National Oceanic and Atmospheric Administration (NOAA) Office of Ocean and Coastal Resource Management to create a summary of sea level rise initiatives of coastal programs across the nation. (This can be viewed at http://seagrant.gso.uri.edu/ccd/slr/SLR_policies_summary_Mar6_final.pdf)

“We found out that several states aren’t doing anything,” Rubinoff says. “Others are coming at it very differently, through outreach, research, established commissions, or general policy. There’s not a lot of consistency.”

New Policy

The resulting policy information was presented during a workshop with the science panel and policy makers in the coastal council, state building commission, and senate policy office.

The group’s consensus was that the rate of sea level rise that should be planned for is 3 to 5 feet, but that the coastal council should

review these figures frequently and adjust them as necessary.

This is the rate that will be used for future permitting, giving the state building commission the guidance needed to incorporate additional building elevations, or freeboard, into the state building code.

Fugate says this is just a start in the council’s efforts to address issues resulting from climate change. “Right now we have more questions than answers. This is a skeleton that still needs to be fleshed out.”

Fleshing Out

The Metro Bay SAMP planning group is helping to put some meat on the regulatory bones by creating specific polices for sea level rise in the Providence area that will also be recommended for state implementation.

“Looking at a specific area through the SAMP process really helped us identify real issues,” Rubinoff says. “We’re a small state, so it’s easy for us to take some of these issues from one place and adapt it statewide.”

Continued on Page 9

Ohio’s Nonpoint Source Program Statewide in Scope, Local in Approach

Nonpoint source pollution is the cause of 75 percent of water quality degradation in Ohio. To address nonpoint pollution issues more comprehensively, the state is taking a local approach.

“We feel like the linchpin is having that person out there.”

*Greg Nageotte,
Ohio Department of
Natural Resources*

The state’s Watershed Coordinator Grant Program provides funding and support for local governments, nonprofits, and other organizations to hire a staff person to identify water quality impairments, coordinate area stakeholders, and develop and implement watershed action plans.

“The grants provide the personnel and training, and align funding so the locals can work together to actually do some things that they identify are important,” says Greg Nageotte, watershed program manager with the Ohio Department of Natural Resources (DNR) Division of Soil and Water Conservation.

In 1999, the Ohio DNR, Ohio Environmental Protection Agency, and Ohio State University Extension got together and asked the state legislature to provide funding for the program.

“The legislators were impressed that agencies were working together

on a common proposal,” Nageotte says. Monies were provided to fund the grants, provide training and technical support to the watershed coordinators, and match federal 319 Clean Water Act grant monies.

The agencies began issuing grants in 2001. They offer watershed organizations up to \$35,000 a year, with a 20 percent local match, to pay the salary and benefits of the coordinator position. A goal of the 3- and 4-year grants is “for them to build capacity and ultimately be able to fund the position,” he says.

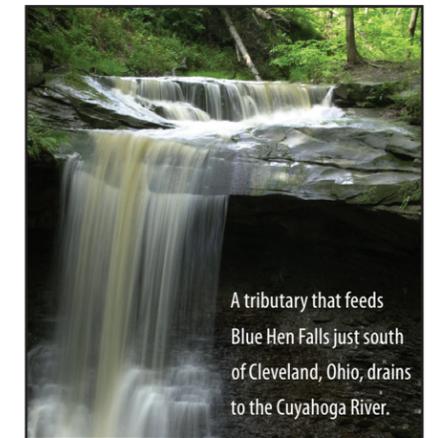
Other program funding has since been added by the Ohio Division of Wildlife, Office of Coastal Management, and Mineral Resources Management.

Each watershed action plan developed by the watershed coordinators and local partners is reviewed and endorsed by Ohio DNR and the Ohio Environmental Protection Agency Division of Surface Water.

“This ensures that watershed plans from around the state are produced with consistent quality and content,” says Matt Adkins, coastal nonpoint source coordinator for the Ohio DNR Division of Soil and Water Conservation. There are 40 endorsed plans so far.

The plans can include best management practices, restoration projects, policy initiatives, resource protection, and education and outreach.

In 2002, the state’s watershed planning guidance was revised



to require that all coastal area watershed plans include a strategy to implement 6217 Coastal Nonpoint Program management measures. “The 6217 program in Ohio is viable even though the federal funding has been inconsistent,” Adkins says.

Nageotte notes that while developing the plans is voluntary, Ohio requires that approved action plans be in place before organizations are eligible for federal and state water quality funding.

“We feel like the linchpin is having that person out there,” Nageotte says. “There are a lot of communities who want to do planning and implementation work across jurisdictional boundaries that just don’t have the staff or expertise.”

He adds, “It serves our state well to have the folks out in the field coordinating activities.” ❖

For more information on Ohio’s Watershed Coordinator Grant Program, point your browser to www.dnr.state.oh.us/soilandwater/water/watershedprograms/default/tabid/9192/Default.aspx. You may also contact Greg Nageotte at (614) 265-6619, or Greg.Nageotte@dnr.state.oh.us, or Matt Adkins at (419) 609-4102, or Matt.Adkins@dnr.state.oh.us.

Students Take California Sanctuary's Bait to Learn about Sharks

Mention sharks and many people begin hearing the music from *Jaws*. The Sharkmobile has hit the streets of the San Francisco Bay area to take a bite out of misinformation about the much maligned species.

"Most students are surprised to learn that sharks play a vital role in the health of the marine ecosystem, eat a variety of foods, and are not really the 'man-eaters' that are often portrayed in the media," says Christy Walker, education specialist with the Gulf of the Farallones National Marine Sanctuary.

The sanctuary's Sharkmobile is a traveling, one-hour classroom program that enables fourth through sixth graders to explore the biology and natural history of sharks from around the world, with a particular focus on great white sharks made infamous in *Jaws*.

"The white shark is one of the ambassadors of our sanctuary," says Walker, pointing out that "great" isn't part of the white shark's official name.

"Some of these kids have never been to the ocean, even though they live so close."

*Christy Walker,
Gulf of the Farallones
National Marine Sanctuary*

The Farallon Islands, located 27 miles west of San Francisco, host one of the largest seasonal feeding populations of white sharks in the Pacific from roughly August through November.

"The Gulf of the Farallones' waters are home to many types of sharks, not just white sharks, but it's the white sharks that get most of the press," says Walker.

The Sharkmobile program was developed in 2004 by sanctuary education consultant Jenny Nelson and reaches students in eight different counties.

"Some of these kids have never been to the ocean, even though they live so close," notes Walker. The Sharkmobile is "a great way to get out into the schools and expand our reach beyond the kids who come to the shore and our visitor center."

The program is conducted for no more than 35 students at a time, up to three days a week during the school year. Two to three programs are done by Walker and other part-time sanctuary staff members during each school visit.

During the program, students get to study shark video taken by a local researcher, examine the jaws, teeth, and egg casings of a number of different species, get an up-close look at preserved leopard and salmon sharks, and see examples of shark products, such as a sharkskin boot and shark-fin soup. Students discuss shark myths and also partake in a shark classification exercise.

The program is tied to state standards and the mission of the sanctuary's education plan, which is to increase ocean literacy and connect people in the region to the sanctuary and ecosystem.

"It's been great," says Walker. "We've done over 235 programs and have had over 7,000 participants."

She adds, "Sharks are easy to get kids excited about and interested in." ❖

For more information about the Sharkmobile, contact Christy Walker at (650) 712-8948, or Christy.Walker@noaa.gov.



Continued from Page 6

Among the SAMP's recommendations are more stringent building standards, flood ordinances, permitting processes, and best practices in coastal flood zones to reduce vulnerabilities to existing and future infrastructure. Also included are building setbacks and elevations, monitoring, and requirements for stricter flood-zone standards.

The SAMP also recommends incorporating climate change considerations into low impact design standards for stormwater management.

No Easy Answers

While Rhode Island coastal managers are proud of the progress they have made in addressing sea level rise and climate change, the challenge before them is daunting.

"The hardest thing that we have had to come to grips with is that there aren't a lot of hard and fast answers out there," Fugate says. "We're going to have to learn to live with that for the time being."

He adds, "We've made the choice to go forward now and try to adapt rather than wait for more information. If you wait for all the answers, you're really placing your coastal population at risk." ❖

To view the draft chapter on natural hazards in the Metro Bay Special Area Management Plan (SAMP), the science report prepared for the Rhode Island Coastal Resources Management Council, the summary of other state coastal program initiatives to address sea level rise, and the coastal council's new sea level rise policy, point your browser to <http://seagrant.gso.uri.edu/ccd/haz.html>. For additional information, contact Grover Fugate at (401) 783-7112, or gffugate@crmc.ri.gov, or Pam Rubinoff at (401) 874-6135, or rubi@crc.uri.edu.

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