COASTAL SERVICES

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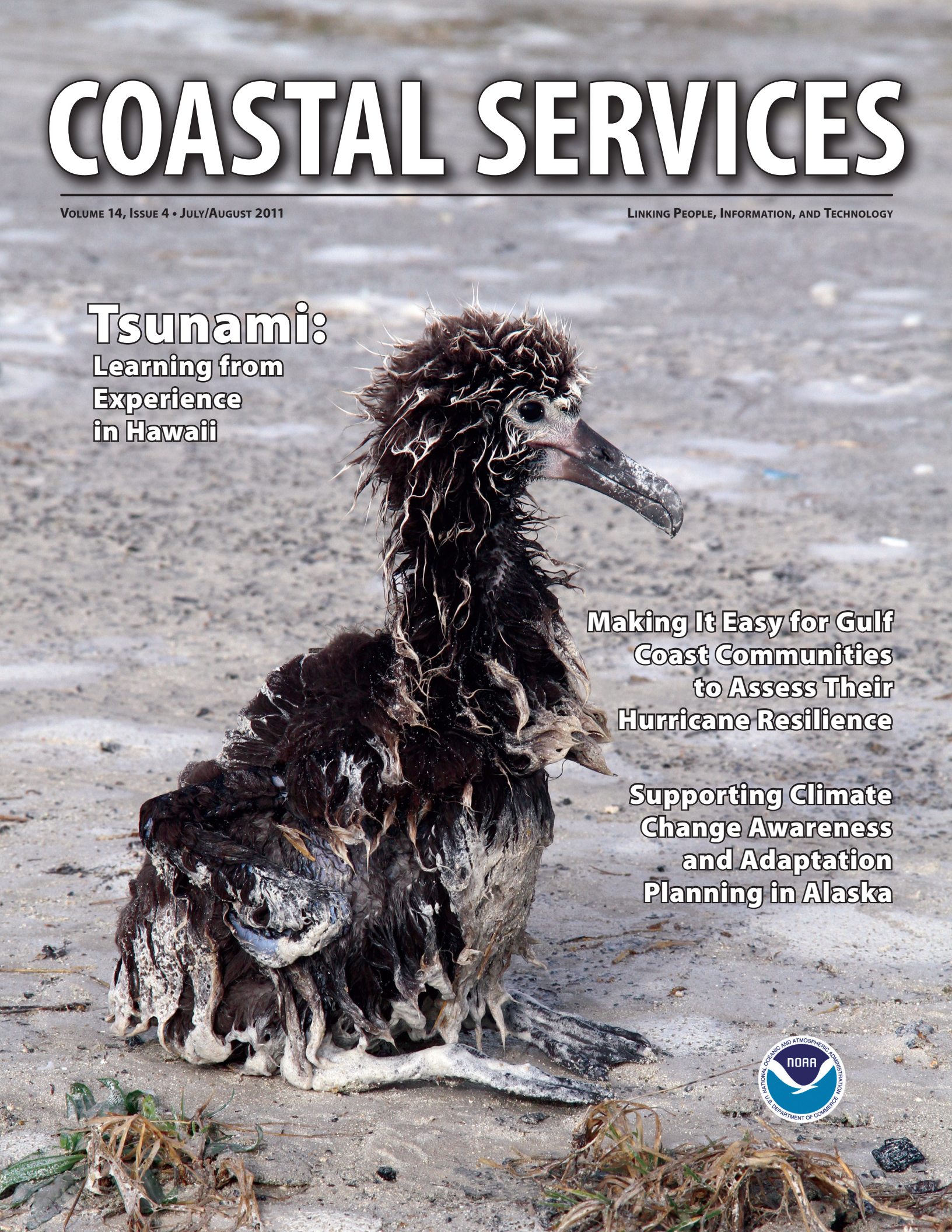
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY



Tsunami: Learning from Experience in Hawaii

Making It Easy for Gulf Coast Communities to Assess Their Hurricane Resilience

Supporting Climate Change Awareness and Adaptation Planning in Alaska

From the Director

Tsunamis can strike any coastline in the world and can affect locations thousands of miles away from where they formed. They may be uncommon, but the devastation they cause makes them a deadly force in nature.

While tsunamis are not as frequent on the U.S. East Coast and in the Gulf of Mexico and Caribbean as they are in the Pacific, they do pose a threat, and coastal communities need to be prepared.

In this edition of *Coastal Services*, the cover article looks at the lessons Hawaii coastal resource managers learned from the tsunami that was generated by the magnitude 9.0 earthquake that devastated Japan in March. During that event, Hawaii experienced more than $30.6 million in damages to homes and resorts, the loss of significant wildlife, and impacts to protected beaches.

While Hawaii's coastal managers were well prepared for a tsunami event and no human lives were lost, lessons were learned that may benefit other managers in areas at risk from tsunamis, storm surge, or coastal flooding.

Our writers also look at the Coastal Community Resilience Index, an easy-to-use tool developed for Gulf Coast communities to assess how prepared they are for storms and storm recovery.

To help communities with their assessment, the NOAA Coastal Services Center has worked with the NOAA Coastal Storms Program and the Gulf of Mexico Alliance (GOMA) to develop an interactive online mapping tool that provides an initial assessment of a community's critical facilities and roads within the Federal Emergency Management Agency flood zone. With information available for the entire Gulf of Mexico, the Critical Facilities Tool can be accessed at *www.csc.noaa.gov/criticalfacilities/*.

Other articles in this edition include how Massachusetts coastal resource managers are encouraging residents to create edible landscaping to help reduce nitrogen and carbon in the atmosphere—both contributors to climate change—and a new online resource for Alaskans that provides tools, videos, and publications that can raise climate change awareness and support local adaptation efforts.

As always, we hope you find these articles 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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National Oceanic and Atmospheric Administration
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Coastal Services Center

On the cover: A Laysan albatross chick on Midway Atoll after the March tsunami.

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

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News and Notes

NOAA Aids for Coastal and Marine Planning

Some coastal resource managers are placing "coastal and marine planning" much higher on their to-do lists as a result of rising national interest and activity in developing offshore renewable energy resources. As one of the lead federal agencies in coastal and marine planning, NOAA can help.

Over the past two years, the U.S. has established both a planning framework for offshore areas and a regulatory process for developing renewable energy in federal waters.

And last February, the U.S. Department of Energy and U.S. Department of the Interior unveiled a plan to streamline the development of offshore wind energy as part of Interior's "Smart from the Start" program. The plan makes available more than $50 million in funding that is intended to get rid of market barriers and speed the development of next-generation technologies. (See *www1.eere.energy.gov/femp/news/news_detail.html?news_id=16709*.)

While enthusiasm about wind energy is driving interest in coastal and marine planning, many other sectors need to be involved, too—the fishing industry, national security interests, officials leasing submerged lands, coastal community developers, and agencies protecting critical habitat, to mention just a few.

At *www.csc.noaa.gov/cmsp/*, the NOAA Coastal Services Center provides the guidance, tools, and data that can ease the learning curve for coastal managers who need to start planning for uses of coastal and marine areas.

Multipurpose Marine Cadastre

This screening tool enables users to find authoritative and relevant data and information to refine wind-energy site searches, create and customize detailed maps, and address project ideas with collaborators, regulators, and stakeholders. The cadastre also provides a communication link among stakeholders, who can send maps back and forth via e-mail, sit face-to-face and view information, or present maps and data in public meetings. This ongoing project is led by the Center and the U.S. Department of the Interior's Bureau of Ocean Energy Management, Regulation and Enforcement.

Offshore Renewable Energy Planning Site

The tools, guides, data sets, and trainings featured on this website can support anyone with a role in finding the best offshore renewable energy locations. A resource sampling includes CanVis, a visual simulation tool that can illustrate the visual impact of offshore wind turbines; the Benthic Terrain Modeler, which helps users examine the deepwater environment; and a guide, *Marine Managed Areas: Best Practices for Boundary Making.*

Legislative Atlas

Organizations interested in coastal and marine planning and regional ocean management will appreciate how the Legislative Atlas provides quick access to the complex set of laws governing the nation's ocean waters. With the atlas, users pinpoint and view on a map the laws, policies, and jurisdictions that apply to their specific coastal areas. Also, users are able to download laws in the form of spatial data. ❖

To learn more about the NOAA Coastal Services Center's coastal and marine planning resources, contact Adam.Bode@noaa.gov.

Making It Easy for Gulf Coast Communities to Assess Their Hurricane Resilience

The first step in creating communities that are resilient to natural hazards, such as hurricanes, is to assess strengths and weaknesses so that local leaders can take action to better prepare for a future event. Coastal resource managers in Mississippi and Alabama have developed an easy-to-use tool for Gulf Coast communities to examine how prepared they are for storms and storm recovery.

"This is a simple and inexpensive method of predicting how well a community will be functioning after a disaster," says Tracie Sempier, the coastal storms outreach coordinator for the Mississippi-Alabama Sea Grant Consortium, who helped develop the tool for the Gulf of Mexico Alliance (GOMA).

The Coastal Community Resilience Index is an eight-page questionnaire that can be completed in one to three hours by a facilitated group of community leaders using readily available information. Asking mainly "yes" or "no" questions, the index covers six areas that need to be strong in order for communities to be able to bounce back after a disaster.

To ensure the tool's effectiveness in diverse communities, it was extensively tested throughout the Gulf region. Managers in South Carolina and other areas are already looking to see if the index would be applicable in other regions—and for other natural hazards.

Extensive Evaluation

The idea for a Gulf-wide vulnerability assessment tool was born out of an informal needs assessment conducted in 2006 by the GOMA resilience team.

The index was developed by staff members at Louisiana Sea Grant and Mississippi-Alabama Sea Grant with funding from the NOAA Coastal Storms Program and GOMA. The draft index was piloted in 16 communities across the Gulf before it was released early this year. "We wanted to get as diverse feedback as possible," Sempier says.

Facilitator Training

The next step, Sempier says, was to train facilitators from around the Gulf to help communities complete the index and address weaknesses.

In February, 45 people attended the first of three regional trainings funded by the U.S. Environmental Protection Agency's Gulf of Mexico Program and GOMA.

Each Gulf state had at least two people at the training. Those participating in the training included staff members from Sea Grant and extension programs, national estuary programs, and national estuarine research reserves.

"We wanted people who already have contacts with local communities and have knowledge that will help communities implement mitigation actions," says Jody Thompson, the Mississippi-Alabama Sea Grant Consortium's regional outreach coordinator for the index. "The intention is to not only help communities complete the index, but to help identify some next steps the community can take to address other hazards, such as impacts from climate change."

> *"Often, this can be the first time this group of people is sitting in a room together when there isn't an emergency."*
>
> *Tracie Sempier, Mississippi-Alabama Sea Grant Consortium*

A database is being kept of the communities that conduct an assessment and their mitigation efforts. Since February, assessments have been conducted in Alabama and Florida.

"So far, the resounding response has been that this works for them," Thompson says.

Team Building

A community can request an assessment, but Thompson says most often, a facilitator will initiate an assessment.

The facilitator will then work with a community to determine the people who should be part of the assessment team. These can include emergency and floodplain managers, coastal managers, local officials, such as the mayor and planning and public works directors, transportation officials, and even nonprofits and area business leaders.

Creating Scenarios

Once assembled, the group works together to complete a paper-based version of the index.

The first step is for the team to create a hazard scenario. "We usually have them start with a storm that they remember," Sempier says. "We then ask them to create a future storm that would be 50 percent worse than what they have seen."

Imagining something worse than Katrina is "pretty challenging for the folks who went through that storm, so we just ask them, 'what would something worse look like?'" she says.

Anticipating Impacts

Using the created scenario, the assessment team then answers questions about potential impacts in six areas—critical facilities and infrastructure, transportation, community plans and agreements, mitigation measures, business plans, and social systems.

"A lot of the effectiveness of the tool is the process they go through," Sempier says. "Often, this can be the first time this group of people is sitting in a room together when there isn't an emergency."

After Hurricane Katrina.

At the end of each section, scores are added up that equate to low, medium, or high. The facilitator then helps lead a discussion about what the community can do to bring up lower scores. Thompson notes that the scores are "intended to guide the discussion. They are not intended for comparison between communities."

Building Strength

The session ends with the facilitator providing links to resources and information that match up with the community's needs.

A supplementary tool to help communities assess their resilience is an interactive online mapping tool developed by the NOAA Coastal Services Center that helps identify critical facilities and roads within a county or city flood zone. The map can be accessed at *www.csc.noaa.gov/criticalfacilities/*.

Facilitators will follow up with communities after a year to complete a second assessment and determine how well the communities are working to address weaker areas. "We're hoping the follow-up assessments will help us figure out needs so that we can push additional resources to them," Sempier says.

Both Sempier and Thompson think the tool would easily translate to other states and regions. Both North and South Carolina Sea Grant programs have already expressed interest in adapting the index, and the Extension Disaster Education Network (EDEN) is interested in adapting the index for inland areas and for other natural hazards.

"We are so willing to share all that we've done and our experiences with this," Sempier says. "We are eager for other communities to try it." ❖

To view the Community Resilience Index and related support tools, go to www.masgc.org/ri/. For more information, you may contact Tracie Sempier at (228) 818-8829 or tracie.sempier@usm.edu, or Jody Thompson at (251) 438-5690 or jody.thompson@auburn.edu.

Photo courtesy of Mississippi-Alabama Sea Grant Consortium

TSUNAMI:
Learning from Experience in Hawaii

About four hours after the magnitude 9.0 earthquake devastated Japan in March, tsunami waves generated by the quake struck the western Hawaiian Islands, destroying homes and resorts, killing significant wildlife, and strewing toxic debris along protected beaches. While Hawaii's coastal resource managers were well prepared for a tsunami event and no human lives were lost, lessons were learned that may benefit other managers in areas at risk from tsunamis, storm surge, or coastal flooding.

"We are very fortunate not to have suffered any loss of human life or other tragedy, as have the people in Japan, and for that we are very grateful," says Barry Stieglitz, project leader for the Hawaiian and Pacific Islands National Wildlife Refuges. "But this tsunami was indeed a disaster at many levels, including for wildlife."

Among the key lessons managers cite are the importance of ongoing public education and outreach; not just having a plan in place, but continually practicing it; and the need for better coordination and planning after an event, which should include everything from sounding the all clear to addressing the emotional needs of personnel, as well as having emergency regulations in place that ensure speedy rebuilding that results in a stronger and more protected shoreline.

"It's not a matter of *if* a tsunami or other disaster will strike, but *when*," cautions Dolan Eversole, Hawaii Sea Grant extension agent and NOAA Sea Grant Coastal Storms Program Pacific regional coordinator. "People need to be prepared and be proactive."

Urban Impacts

The tsunami waves arrived in Hawaii a little before midnight on March 10, continuing through the early hours of March 11, says Stieglitz.

On the inhabited islands, five hours of warning was enough to move visitors and residents safely to evacuation centers or higher ground, says Quince Mento, Hawaii County Civil Defense administrator.

On the island of Oahu, 3-foot waves rushed ashore in Honolulu, swamping Waikiki's beach and surging over the breakwall, but stopping short of the area's high-rise hotels. On the western side of the Big Island—where most of the damage to urban areas occurred—10-foot waves damaged and destroyed homes and resorts, and inundated many areas with sand and debris.

Overall estimates of damage in Hawaii exceed $30.6 million, with more than $14 million coming from the Big Island alone.

Out in the Field

In remote research camps in the uninhabited Hawaiian Islands Refuge, which is part of the Papahanaumokuakea Marine National Monument, staff members and volunteers were having diverse experiences, says Stieglitz.

On Midway Island, 60 to 70 staff members and contractors were secured in the third floor of an air-conditioned World War II military bunker and were able to monitor tsunami waves in real time on island tide gauges. They maintained Internet access throughout the event and were able to follow online media reports.

"Everybody knew what to do," says Stieglitz. "They had a plan that was rehearsed, and everything went very well."

> *"People need to be prepared and be proactive."*
>
> *Dolan Eversole, Hawaii Sea Grant*

In the much smaller and more primitive tent camp on Laysan Island, where the highest elevation is a 30-foot dune, short-term researchers and volunteers waited for tsunami waves sitting in life rafts tethered to a metal emergency shelter wearing immersion suits to protect them from hypothermia should they be swept into the North Pacific. With limited communication, they waited for hours in the dark listening to the series of waves.

"They had a plan in place, but they did not rehearse it, and that was a problem for us," Stieglitz says.

The experience of the tsunami and the resulting devastation on the island, which included the beaches being littered with unidentified barrels of toxic materials and old military munitions, was emotionally traumatic for some staff members and volunteers.

Although their stint on the island wasn't due to end for several weeks, "we ended up evacuating them fairly quickly," Stieglitz says. "You have to make people's emotional well-being the priority."

Wildlife Impacts

Wildlife in the refuge was also severely impacted, Stieglitz says. More than 110,000 Laysan and black-footed albatross chicks—about 22 percent of the year's albatross production—were lost as a result of the tsunami and two severe winter storms in January and February. At least 2,000 adults were also killed. A number of other seabird species were killed, but their numbers are unknown.

Biologists are confident that, absent any other stressors, the albatross population could rebound from this event, Stieglitz says, but "we remain concerned about the compounding effect of this tsunami on the existing stresses of invasive species, global climate change, incidental mortality from longline fishing, and other threats to albatross and other wildlife populations."

Practice, Practice, Practice

What consistently went well during the event, managers say, was not only having a tsunami plan in place, but actively practicing the plan.

"I think practice, practice, and developing good relationships with partner agencies so that you know them on a personal level before an event helps facilitate the process," says Mento.

"I think we've got the before part down pretty good," agrees Bethany Morrison, a planner for the County of Hawaii. "We just need to keep people educated and aware."

Ongoing Education

Other managers also point to the need for ongoing education and outreach to a variety of audiences ranging from residents and government personnel to the media and hotel staff members.

"In gauging the success of our past outreach efforts, I believe there has been a positive impact," says Ann Ogata-Deal, planning and policy analyst with the Hawaii Coastal Zone Management Program. "We held a training session focused on educating the media and hotel security. These are two very critical partners in tsunami mitigation."

Eversole points to numerous Sea Grant outreach efforts as being important, including several hazards publications targeting county planners and engineers, as well as residents.

Ogata-Deal notes, "Just looking at things overall, it takes many years of work to see significant, long-lasting results. You can't always point to one thing that made the difference in any hazard event. It's more of the combined outreach efforts of many different people over extended periods of time that makes a difference."

The Aftermath

Where more emphasis is needed, managers agree, is in planning for what happens after an event.

Mento cites the need for better statewide communication for determining when it is safe to go back to coastal areas and open beaches and marinas. "Varying definitions of 'all clear' took us by surprise. If people can't go back to their businesses and homes, then it's not all clear."

There is also interest in being more effective in recovery planning and coordination, notes Gordon Grau, director of the Hawaii Sea Grant Program.

"I have been impressed with the degree of coordination among local and state and federal offices that focus on hazard preparedness, and

Continued on Page 9

This and cover photo courtesy of U.S. Fish and Wildlife Service

Encouraging Coastal Residents to Eat Their Landscaping in Massachusetts

Incorporating food-producing plants into beautiful landscapes is an environmentally friendly trend that Massachusetts coastal resource managers are encouraging residents to sink their teeth into. In addition to augmenting dinner tables, edible landscaping can help reduce nitrogen and carbon in the atmosphere—both contributors to climate change—as well as reducing detrimental nitrogen loads in coastal waters.

"This is kind of the cool thing to do now," says Terry Soares, co-owner of Soares Flower Garden Nursery in Hatchville, Massachusetts. "I've noticed for the last few years that a real trend with gardeners is to reduce their lawn area and find an attractive way to incorporate vegetables and fruit into the landscape design."

The environmental benefits of the trend are good enough—and the topic so intriguing—that Waquoit Bay National Estuarine Research Reserve worked with Soares to develop a workshop on how to do edible landscaping as part of its ongoing Reducing Your Nitrogen Footprint series.

"We are trying to help people find out about the positive things they can do to counteract what's happening to our local waters," says Joan Muller, the reserve's education coordinator. "It's also a topic that would get people in their busy lives to come to an evening program."

Nitrogen Overload

Nitrogen overloading is a serious problem in Massachusetts' estuarine waters. Reserve research shows that excessive nitrogen is causing an overgrowth of algae, which is outcompeting the eelgrass that provides the nursery grounds for many fish and other aquatic species.

In addition, an overgrowth of algae depletes oxygen in waters, killing marine life, increases the incidences and duration of harmful algal blooms, and lowers species diversity.

While agriculture, septic tanks, and lawn and garden fertilizers may spring to mind as the most common sources of nitrogen, atmospheric deposition from the burning of fossil fuels has the same impact on water quality.

For the U.S. as a whole, atmospheric deposition of nitrogen from smokestacks and tailpipes is estimated to contribute 40 percent of the nitrogen that reaches coastal rivers and bays. The rate of atmospheric nitrogen deposition in southeastern New England is among the highest in North America.

In addition to degrading coastal water quality, atmospheric nitrogen is a contributing factor in climate change.

Combining Concepts

As part of the Reducing Your Nitrogen Footprint series, Muller has worked with gardeners and landscapers to create workshops on organic gardening and ecological landscaping, which involves practices such as reducing lawn area, using native plants, composting, and mulching, and has developed programs with groups that promote eating locally grown food.

"I was intrigued by edible landscaping because it combines all these concepts," Muller says. "Not only are you using less fertilizer and reducing lawn areas, but an added bonus of growing your own food is that you aren't using all that fuel in order to get food to your area. It reduces both your nitrogen and carbon footprint."

According to advocates, edible landscaping also is beneficial because fewer gas- or electric-powered tools, such as mowers and blowers, are used in its maintenance, compared to traditional lawns.

Trend Defined

Edible landscaping uses fruit- and vegetable-bearing plants, herbs, and edible flowers throughout yards to turn the traditional lawn into a more utilitarian—but still decorative—space.

Soares says the same design principles used for ornamental landscapes are applied—but with creativity. For instance, a walkway might be bordered with lettuce, cucumber vines might crawl up a decorative trellis, or mint might be used as a ground cover.

Edible landscaping can also be as simple as growing decorative containers of herbs and vegetables alongside flowerpots on a patio.

"Landscaping is about outdoor decorating," Soares says. "Adding the food component is part of the trend we see happening."

Workshop

In doing the Reducing Your Nitrogen Footprint series, Muller says she consistently turns to the experts. "We can provide the context and the why it's important to the environment, but people really need practical information in order to be able to do it."

> ***"We are trying to help people find out about the positive things they can do to counteract what's happening to our local waters."***
>
> *Joan Muller, Waquoit Bay National Estuarine Research Reserve*

During the edible landscaping workshop held in early May, Soares brought in sample plants and decorative container gardens, which were given out as door prizes, and focused on the types of plants that work well in edible landscaping, where to site them, and how to make them aesthetically pleasing.

A local bakery also prepared snacks with local fruits and herbs, and the 25 attendees all went home with seed packets. "People like food, and all these little things help reinforce the message," Muller says.

Both Muller and Soares see the potential for incorporating edible landscaping into future reserve activities, such as a seaside garden tour where edible landscapes could be viewed.

"Anybody could do an edible landscaping workshop," Muller says. "It's primarily about incorporating what would work locally."

She adds, "It's nice that we don't always have to be doom and gloom. This was a really positive and fun workshop to do—and tasty!" ❖

For more information on the Reducing Your Nitrogen Footprint series, contact Joan Muller at (508) 457-0495, ext. 107, or joan.muller@state.ma.us. For more information on edible landscaping, contact Terry Soares at (508) 548-5288 or mtscapecod@gmail.com.

EDIBLE LANDSCAPING RESOURCES

Designing and Maintaining Your Edible Landscape Naturally
By Robert Kourik
In the 1980s, Kourik, a landscape designer and environmentalist, is reported to have coined the term "edible landscaping" to denote a new kind of gardening that marries aesthetic design with crop production.
www.robertkourik.com/books/edible.html

Edible Landscaping: Now You Can Have Your Gorgeous Garden and Eat It Too!
By Rosalind Creasy
Creasy is credited with popularizing the concept of landscaping with edibles. The book presents everything readers need to know to create a decorative home landscape that will yield vegetables, fruits, nuts, and berries.
www.rosalindcreasy.com/edible-landscaping-basics/

Animal, Vegetable, Miracle: A Year of Food Life
By Barbara Kingsolver
Kingsolver and her family made a commitment to become "locavores"—those who eat only locally grown foods—for a year. This entailed growing and raising their own food and supporting local farmers.
www.animalvegetablemiracle.com

Photo courtesy of Waquoit Bay National Estuarine Research Reserve

Supporting Climate Change Awareness and Adaptation Planning in Alaska

Storm surge and melting permafrost have contributed to coastal erosion in Alaska.

Coastal communities in Alaska are threatened by climate-change-related impacts that include melting sea ice, ocean acidification, and shifts in sea animals, game, and harvested plants. Despite these changes, many Alaskans express skepticism about the reality or seriousness of climate change.

Yet seacoast villagers and native Alaskan coastal residents are much more likely to maintain their ways of life if they become aware of local impacts and find ways to adapt. Local economies are often highly dependent on natural resources, and subsistence hunting, harvesting, and fishing practices have been passed down for generations.

A new online resource provides tools, videos, and publications that can raise climate change awareness and support local adaptation efforts. The site, Living on Alaska's Changing Coast: Adapting to Climate Change in Coastal Alaska, was developed by Alaska Sea Grant.

"The impacts of climate change are happening here earlier and more dramatically than in many other states," says Terry Johnson, a Marine Advisory Program agent for Alaska Sea Grant.

For instance, intensified storm surges and thawing permafrost are contributing to coastal erosion in Alaska, with some shorelines receding up to 100 feet after a single storm. The U.S. Army Corps of Engineers reports that 160 communities in the state are threatened by climate-related erosion, and six communities are planning partial or total relocation.

Living on Alaska's Changing Coast aims to reach coastal communities and businesses on the front lines of change. "Our message is that there is such a thing as climate change, that many things they've observed are backed up by the findings of scientists, and that they can find ways to adapt, either on their own or with technical assistance," says Johnson.

Fact sheets and videos reinforce this message. On-the-ground observations by native Alaskan villagers are paired with scientific findings on subjects such as storm surge and permafrost.

"Our hope is that, for example, someone living along the Bering Sea coast reads the fact sheets or listens to the interviews of people in his area and thinks, 'I've noticed that change, too,'" notes Johnson.

The site's adaptation resources reflect Alaska Sea Grant's outreach approach: "We get the dialogue going by posing questions and offering support when invited, not telling people what to do," says Johnson. The question-and-answer format can help communities identify concerns, suggest different adaptation strategies, consider the practical benefits of each strategy, and arrive at a plan for implementation.

> *"The impacts of climate change are happening here earlier and more dramatically than in many other states."*
>
> *Terry Johnson, Alaska Sea Grant*

Early responses to the website have been positive, and additional funding by the Alaska Center for Climate Assessment and Policy will enable Alaska Sea Grant to develop and add more resources.

Is Johnson concerned about reaching the target audience? "We don't expect major access problems," emphasizes Johnson, "because even remote villages are surprisingly well-connected to the Web." ❖

To view Living on Alaska's Changing Coast, go to http://seagrant.uaf.edu/map/climate/index.php. For more information, contact Terry Johnson at (907) 274-9695 or terry.johnson@alaska.edu.

Photo by Benjamin Jones and courtesy of Alaska Science Center

Continued from Page 5

on their highly positive interactions with NOAA and Sea Grant," Grau says. "The recovery and rebuilding coordination is where we can still improve and are working towards that collectively."

He adds that criteria for rebuilding need to be planned before an event so that the area comes back stronger and more resilient to future tsunamis or storms.

Better documentation of the damage immediately after the event is also needed, notes Morrison.

Almost Normal

Three months after the tsunami, the areas that were most impacted are "almost back to normal," Mento says. "The recovery has gone pretty well."

The lessons learned from this event are being incorporated into plans for the "next one," Stieglitz says. "With global climate change, there's more of an imperative now to be prepared for all these types of events. You have to plan, practice, plan for the aftermath, and practice."

He adds, "We've learned a lot from past experiences and have really improved our response. Next time, we'll do this a little bit better." ❖

For more information on Hawaii's tsunami response, contact Quince Mento at (808) 935-0031 or qmento@co.hawaii.hi.us. For more information on research and wildlife impacts, contact Barry Stieglitz at (808) 792-9540 or Barry_Stieglitz@fws.gov. For more information on outreach efforts, contact Ann Ogata-Deal at (808) 587-2804 or aogata-deal@dbedt.hawaii.gov, or Dolan Eversole at (808) 956-9780 or eversole@hawaii.edu. For information on adaptation and rebuilding, contact Gordon Grau at (808) 956-7031 or sgdir@hawaii.edu, or Bethany Morrison (808) 961-8138 or bmorrison@co.hawaii.hi.us.

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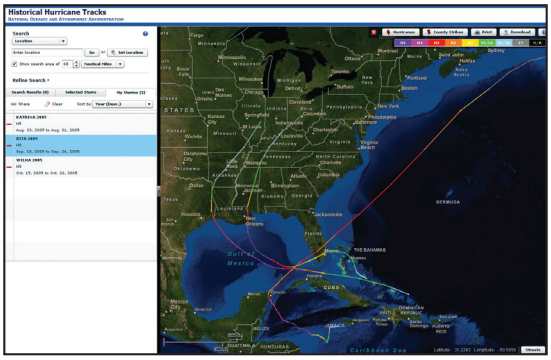

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