

NEEDS ASSESSMENT FOR THE NOAA GULF COAST SERVICES CENTER: FINAL DRAFT

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)
COASTAL SERVICES CENTER



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This needs assessment was produced to fulfill a congressional request following the hurricane events of Katrina, Rita, and Wilma along the U.S. Gulf Coast. This document shall be referred to as a “final draft” until reviewed by the Office of Management and Budget within the Executive Office of the President of the United States.

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Executive Summary

In 2005, the National Oceanic and Atmospheric Administration (NOAA) delivered a report to Congress on the potential establishment of a Gulf Coast Services Center. This report called for a thorough evaluation of needs of the diverse audiences that use NOAA information, products, and services in the Gulf of Mexico region.

In 2006, the NOAA Coastal Services Center established a small Gulf Coast Services Center and initiated a formal needs assessment. This report summarizes information gathered during the eight-month assessment process, which also considered the “Governors’ Action Plan for Healthy and Resilient Coasts” and other ongoing regional efforts. The assessment examined impacts and lessons learned from hurricanes Katrina, Rita, and Wilma, highlighting planning, preparation, and recovery needs, and identified high-priority regional needs and specific issues and processes where the services and expertise of NOAA and the Coastal Services Center could be particularly useful.

The needs assessment will guide the strategic planning of the newly formed Gulf Coast Services Center and shape future products, services, and regional partnerships of the Charleston-based NOAA Coastal Services Center. The assessment also will be shared with partners across NOAA so that the information gathered can be used by the many programs providing assistance in the Gulf of Mexico region. Finally, NOAA will work with external organizations, especially those that can help address priority needs, directly and by leveraging resources and partnerships across the region.

Goal and Methodology

The goal of the needs assessment was to gather information about audiences concerned with coastal management issues in the Gulf of Mexico to inform the design of products and services that support regional ecosystem management and foster community resilience.

The needs assessment process consisted of seven basic steps:

1. Establish a cross-NOAA steering committee
2. Identify target audiences
3. Conduct a literature review
4. Analyze results of the 2006 NOAA Coastal Services Center Customer Survey
5. Convene focus groups of key audiences
6. Conduct interviews (over 70)
7. Analyze and assemble data

The draft report was reviewed by the steering committee and by the new NOAA Gulf of Mexico Regional Team.

Findings: Needs in the Gulf of Mexico Region

While Gulf constituents expressed many issue-specific program and project needs, they repeatedly raised two crosscutting topics:

1. Communication and coordination. Regional customers need help keeping track of the myriad of entities, projects, and resources and facilitating better coordination across local, state, regional, and federal parties.
2. Product delivery. Delivery of products and services is as important as their development. Simply providing more data and more technical tools is not the answer—there is a need for more outreach, training, and technical assistance to ensure that NOAA's information and tools are truly useful to constituents and other users.

The assessment's findings fall into four general areas of need:

1. Needs for supporting and fostering an ecosystem-based approach to the management of coastal resources
2. Needs for increasing community resilience to coastal hazards
3. Data and technology needs
4. Communication and coordination needs

The needs in each of these categories are outlined below.

Supporting and Fostering an Ecosystem-based Approach to Management

- This concept needs to be defined in concrete action steps. There is widespread support for the idea of an ecosystem-based approach, but both resource managers and local decision-makers need a better understanding of how it can be implemented.
- One of the most challenging aspects of implementing an ecosystem-based approach to management is successfully involving the myriad of players who represent the multiple issues and jurisdictions involved.
- Growth and development is the number one issue facing coastal areas of the Gulf of Mexico region. This issue has many associated needs.
- Resource managers need socioeconomic tools and data, as well as natural science information and tools.
- Within the topic of awareness and education, participants stressed the need for education on the connections among elements of ecosystems and between human activity and ecosystem impacts.
- Integrity and diversity of habitat is a key concern in the region. Participants expressed the need for basic identification and mapping, as well as efforts to protect and restore high-priority habitats.
- An ecosystem-based approach requires significant resources, and participants often stressed the need for additional staff members.

Increasing Community Resilience to Coastal Hazards

- As with an ecosystem-based approach, participants said this concept needs to be defined in concrete action steps.

- Many significant recovery needs related to hurricanes Katrina and Rita still exist.
- Participants expressed a need for dialogue about appropriate or realistic levels of resilience for different areas. Some participants felt NOAA could act as a neutral party to begin discussions of alternatives, priorities, and capabilities.
- While there is a need for better risk and vulnerability assessment, effectively communicating risk and vulnerability is equally important.
- Risk should be driving decision-making about development and redevelopment, but it is not.
- Participants need ways to measure resilience, but measurement alone is not sufficient. Participants also need incentives and dialogue about the economic and social aspects needed to foster improvements.
- Within the overall need for dialogue and raising awareness, participants stressed the need to provide economic information and to show the connections between habitat and mitigation.
- Participants emphasized a need for more effective and extensive outreach on surge and sea level rise.
- Planning must take place before disaster strikes.
- Professionals from many fields need to collaborate to understand and enhance resilience. Specifically, the coastal management, emergency management, and land use planning communities must work together.

Data and Technology Needs

- Data, maps, and technical tools are needed to support both an ecosystem-based approach to management and improved community resilience. Participants emphasized a need for tools to analyze and apply raw data.
- Delivery is as important as development. While Gulf of Mexico resource managers use and value existing NOAA data, tools, and training, the region needs more outreach, training, and technical assistance to ensure that tools are accessed and applied on the ground.
- While many resource managers and partners now have geographic information system (GIS) capacity, they need ongoing training on this technology.
- As the region collects more and more data, resource managers and partners have an ongoing need for improved data management, access, sharing, and standards.
- NOAA should consult state and local entities when it develops regional or national databases. These entities have data to contribute, and NOAA could enhance the utility of such databases at the local level with early involvement.
- Because not everyone can access and use technical tools and “e-products,” NOAA should not abandon traditional mechanisms such as hard copy maps.

Coordination and Communication

- In this topic, participants mentioned most frequently that NOAA must better coordinate outreach for its products and services. Customers are not aware of the myriad of products and services available to them through NOAA programs.
- A central challenge for customers and partners is simply keeping track of everything that is going on, and all the resources available, in the Gulf region.
- Participants emphasized the need for education and outreach across issue areas, with an emphasis on science translation.
- Regional customers said NOAA should be doing outreach to local officials and planners, as well as to more traditional audiences such as resource managers and K-12 educators.

- The assessment confirmed that different individuals prefer different communication mechanisms. It also demonstrated that customers desire face-to-face exchange.
- Many existing and potential partners in the region can contribute to communication and coordination efforts. NOAA should capitalize on the communication mechanisms, networks, and facilities these entities have to offer.
- The Gulf of Mexico Alliance has a lot of potential and has encouraged valuable coordination across federal agencies. Regional partners are pleased that the fiscal year 2008 NOAA budget request includes funding for the alliance to support further progress.
- Although the alliance is a step in the right direction, federal agencies must work to better coordinate their activities.
- The Gulf Coast Services Center should work with traditional partners such as Coastal Zone Management Programs and National Estuarine Research Reserves, as well as with less traditional partners such as National Estuary Programs and emergency management entities.
- Participants said that NOAA's Coastal Services Center and the Gulf Coast Services Center are uniquely positioned to help connect emergency managers to technology resources.
- Participants also see NOAA as uniquely positioned to help coordinate regional coastal and marine mapping efforts.

Next Steps: Using the Needs Assessment Results

The needs assessment provides a wealth of information about specific needs related to resource issues and management activities. It provides a snapshot of current activities and capacity in the region and highlights common constraints across all sectors.

The assessment will be invaluable for guiding the efforts of the new NOAA Gulf Coast Services Center, and the findings are already shaping strategic planning efforts. An additional value is the host of key contacts that staff members have made or renewed during the process.

The NOAA Coastal Services Center in Charleston, South Carolina, will also use the information to shape its future activities and will share the assessment results with all line offices. Feedback on existing efforts and newly identified needs point to ways in which the broad NOAA family can continue to bring value to the region.

The newly established NOAA Regional Collaboration Team for the Gulf is composed of representatives from all of NOAA's offices and programs. The NOAA Coastal Services Center has shared this needs assessment with the team to promote outreach and communication of NOAA's products and services in a highly integrated way, and the assessment has helped shape development of collaboration goals and projects for the first year.

Acknowledgments

The needs assessment team would like to thank the members of its cross-NOAA Steering Committee for providing thoughtful input and valuable contacts during the needs assessment process. We also wish to thank those organizations and individuals who allowed us to conduct focus groups at their meetings and conferences. Finally, we would like to thank the many individuals who participated in focus groups and interviews. The suggestions and perspectives they provided will help guide the NOAA Gulf Coast Services Center's development and operation, and we look forward to continuing the dialogue.

Introduction

Background: Congressional Request for Scoping of a Gulf Coast Services Center, State and Federal Support for Regional Efforts

The National Oceanic and Atmospheric Administration (NOAA) Coastal Services Center's primary initiatives involve those issues considered most important to coastal managers— hazards, habitats, resilient communities, land and water use, and data and information access and usability. Recognizing the value of the Coastal Services Center model, Congress requested that NOAA prepare a report describing the potential establishment of a Gulf Coast Services Center that would serve the Gulf of Mexico region.

While the report was being prepared, the governors of Florida, Alabama, Mississippi, Louisiana, and Texas formed the Gulf of Mexico Alliance (GOMA), a regional effort to protect the Gulf of Mexico. The president's "U.S. Ocean Action Plan" recognized the leadership of this regional effort and committed administration officials to meeting with Gulf of Mexico representatives to explore partnership opportunities. NOAA drafted the "NOAA Gulf Coast Services Report" (2005b) to take into consideration these developments. In the spring of 2006, GOMA released the "Governors' Action Plan for Healthy and Resilient Coasts." Thirteen federal agencies, including NOAA, have committed to supporting state priorities identified in this plan.

Delivered to Congress in September of 2005, the "NOAA Gulf Coast Services Report" included a call for a thorough evaluation of needs in the Gulf of Mexico region. The report included an overview of management issues and information and capacity gaps based on several existing reports and input from regional representatives, but the need for a more thorough assessment was recognized, particularly in light of the impacts of the devastating hurricanes of 2005. Assessing the needs of the diverse audiences that use NOAA information, products, and services is essential to determine how a Gulf Center should function, and to identify and prioritize efforts that will add value for customers and partners across the Gulf region.

The Needs Assessment

In the summer of 2006, the Coastal Services Center initiated a formal needs assessment. This report summarizes the information gathered during the eight-month process. The assessment considered the "Governors' Action Plan for Healthy and Resilient Coasts" and other regional efforts, as well as the effects of hurricanes Katrina, Rita, and Wilma and the recovery needs of the region. It confirms high-priority Gulf of Mexico regional needs previously identified, identifies specific issues and processes where the services and expertise available from NOAA and the Coastal Services Center can be particularly useful, and suggests ways in which communication and coordination can be enhanced.

The assessment will guide the strategic planning of the newly formed NOAA Gulf Coast Services Center, which is headquartered at the Stennis Space Center in Mississippi. It will also shape future products, services, and regional partnership efforts of the Charleston-based Coastal Services Center. The assessment also will be shared with partners across NOAA so the information gathered can be used by the many programs providing assistance in the Gulf of Mexico region. Finally, external organizations can use the assessment to help address priority needs directly and to leverage resources and partnerships across the region.

Goal and Objectives

The following goal and objectives guided the needs assessment process.

Goal: Gather information about audiences concerned with coastal management issues in the Gulf of Mexico to inform the design of products and services that support regional ecosystem management and foster community resilience.

Objectives:

- Identify the gap between existing and necessary information and capabilities supporting an ecosystem approach to management.
- Identify coastal-related information and tools that can enhance and promote community resilience.
- Identify needs and drivers that contribute to interest in and access to information, training, and technical assistance by the Gulf of Mexico coastal community.
- Solicit opinions about format and distribution of information, products, and services to maximize their utility for the Gulf of Mexico coastal community.

Methodology

Below is an overview of the steps in the needs assessment process.

1. *Cross-NOAA steering committee established:* A steering committee was formed in July 2006 and included representatives from NOAA programs that are positioned to assist with solutions to the needs identified in the assessment. The committee includes representatives from the Office of Ocean and Coastal Resource Management, the National Sea Grant Office, the National Data Buoy Center, the National Marine Fisheries Service, the National Coastal Data Development Center, and the Office of Response and Restoration. The first meeting of the steering committee took place on September 26, 2006. See Appendix A for a list of steering committee members, and Coastal Services Center staff members working on the needs assessment.
2. *Target audiences identified:* Appendix B provides a list of primary and secondary target audiences. Primary audiences are customers and partners who use, or have the potential to use, NOAA information, products, and services. Secondary audiences include internal NOAA partners and the public. NOAA partners may be both customers of and contributors to Gulf Coast Services Center efforts, and members of the public are “end users” who may access NOAA information, products, and services directly, or through partners. Identifying these audiences helped determine groups and individuals to include in focus groups and interviews, and informed the selection of references for the literature review.
3. *Literature review conducted:* A foundation piece for the assessment, the literature review summarized existing information about audience needs. The assessment team researched documents that concerned issues, activities, and needs of the identified target audiences, and sought out references in three topic areas thought to be of major concern in the coastal Gulf of Mexico:
 - Habitat, which includes habitat characterization, mapping, and restoration
 - Coastal watersheds, which includes the Integrated Ocean Observing System, water quality, nutrient reduction, and Coastal Services Center models and management tools
 - Hazards and community resilience, which includes topics that relate to planning for, mitigating, and responding to coastal hazards

The literature review was completed in the fall of 2006, and results of that review are presented in this report.

4. *Results of the 2006 NOAA Coastal Services Center Customer Survey analyzed:* The Coastal Services Center conducts a periodic customer survey to better understand the issues and needs of the nation's coastal management community, including state regulatory and natural resource management agencies, coastal and marine protected areas, emergency management agencies, and others concerned with the management of coastal resources. Results from the most recent survey were analyzed as part of the needs assessment. Of the more than 400 respondents, 79 were from the Gulf region, and these respondents represented a wide variety of organizations and position types, providing a good cross-section of target audiences. Survey results for the Gulf respondents are summarized in Appendix C and highlighted within the report.
5. *Focus groups held with key audiences:* Focus groups were held at regional conferences and meetings to gather information from key target audiences. These focus groups also promoted sharing of ideas among NOAA staff, academia, nongovernmental organizations, and local, state and federal partners. Discussion areas included 1) strategies to strengthen an ecosystem approach to management in the Gulf, 2) strategies to enhance community resilience, 3) management needs for coastal-related information and tools that NOAA could provide, and 4) communications and information sharing between NOAA and needs assessment audiences. Appendix D identifies focus group locations and participants.
6. *Interviews conducted:* Over 70 one-on-one interviews were conducted to augment the information gathered in the literature review and focus groups. Some interviews were conducted by phone, while others were conducted at regional constituent meetings, workshops, and conferences. Appendix E provides a list of individuals interviewed. Needs identified during both the focus groups and interviews are presented in this report following the literature review results.
7. *Data analyzed and assembled, steering committee asked to review:* Information collected was analyzed and synthesized for inclusion in this report, and a draft was circulated to the steering committee for review. Literature review findings, ideas raised during focus groups, information gathered in one-on-one interviews and at meetings, and steering committee input all contributed to this final report.

THE GULF OF MEXICO

The Gulf of Mexico region is an integral part of our nation's economic and ecological vitality, helping to fuel and feed the nation.

- The Gulf of Mexico is the ninth largest body of water in the world and is of strategic importance to the U.S. for recreation, natural resources, commerce, transportation, homeland security, and military operations.
- Approximately one-sixth of the U.S. population resides along the Gulf coast, and the population is increasing by about five percent annually.
- The Gulf of Mexico region provides three trillion dollars annually to the U.S. economy.
- The Gulf of Mexico is critical to the nation's energy supply, contributing over 44 percent of the crude oil, 43 percent of the dry natural gas, and over 50 percent of liquid natural gas that fuels this nation.
- The Gulf Coast yields 69 percent of the shrimp and 70 percent of the oysters caught in the U.S.
- The Mississippi basin is a major flyway for migratory birds. It is used by up to 40 percent of North America's duck, geese, swan, and eagle populations. Much of the continent's waterfowl population winters along the Gulf Coast.
- Seven of the nation's top ten ports in terms of tonnage or cargo value are located in the Gulf of Mexico, with two of these in the top global seven.
- Drainage into the Gulf of Mexico comes from one of the world's largest river basins and includes an extensive network of national watersheds from 33 states, 20 major river systems, and over 150 individual rivers.
- The Gulf tourism industry provides tens of thousands of jobs worth over 20 billion dollars a year, and the Gulf recreational fishing industry accounts for roughly 30 percent of U.S. saltwater fishing expenditures and 23 percent of U.S. saltwater recreational jobs.
- Natural hazards such as hurricanes threaten all strategic activities in the Gulf. Approximately 92 percent of the Gulf's U.S. oil production and 83 percent of its gas production were idled by hurricanes Katrina and Rita in 2005.

Literature Review

The primary purpose of this review was to provide a foundation from the literature to effectively direct the efforts of a NOAA Gulf Coast Services Center in the Gulf of Mexico region. As outlined above, the literature review was one of several methods used to obtain specific information on the Gulf of Mexico's coastal management needs that the Coastal Services Center and other NOAA offices might address.

A substantial volume of information has been published about the coastal management needs and issues of the Gulf Coast. Such reports and publications have been produced by various sources, including governments (federal, state, local), regional governance groups, private-sector organizations, and academic institutions. Care was taken to select publications for review that concern, or directly affect, coastal communities and the people of the Gulf of Mexico. While this literature review is not a comprehensive synthesis of all literature within the scope of the study, the references selected are representative of issues and groups directly involved in working toward common solutions for the greater coastal management community. (A list of references reviewed appears at the end of this needs assessment report.)

The literature review is categorized by the issues and needs related to two broad topical areas: ecosystem-based management and coastal hazards resilience. A final section identifies cross-cutting needs related to these issues.

The review demonstrated that, although specific needs vary across the five Gulf states, there are a number of common issues of concern across the Gulf of Mexico region. Coastal growth and development, wetland assessment/mapping and conservation, and hazard mitigation and evacuation infrastructure were mentioned in documents from all five states. Recent documents about the Gulf Coast storms of 2005, notably hurricanes Katrina, Rita, and Wilma, further display the critical need for effective management of coastal ecosystems, reduction in the severity of coastal-related hazard impacts, and increased resilience of coastal communities. The impacts of these events emphasize the connections between natural ecosystem processes and human impacts and responses.

Table 1 presents priority issue areas repeatedly raised in the literature. Not all reviewed documents and identified issues are referenced in this document, but the issue areas identified are highlighted because of the high frequency of documentation and the broad geographic coverage within the Gulf of Mexico region. The issues in Table 1 represent a broad spectrum of specific management activities and needs, and the subsequent sections of the document delve into these issues in more detail.

Table 1. Priority Issue Areas Identified in Literature Review

| Literature Cited | Water/sediment quality | Living resources | Public education and outreach | Habitat | Human use | Infrastructure |
|---|------------------------|------------------|-------------------------------|---------|-----------|----------------|
| <i>Apalachicola National Estuarine Research Reserve Management Plan</i> | X | X | X | X | | |
| <i>Charlotte Harbor Comprehensive Conservation and Management Plan</i> | X | | | X | | |
| <i>Charting the Course: The Comprehensive Conservation and Management Plan for Tampa Bay</i> | X | X | | X | | |
| <i>Coast 2050: Toward a Sustainable Coastal Louisiana</i> | | X | | X | | X |
| <i>Coastal Bend Bays Plan</i> | X | X | X | X | X | |
| <i>Coastal Texas 2020 Needs Assessment</i> | X | | | X | X | |
| <i>Comprehensive Conservation and Management Plan, A Call to Action</i> | X | X | X | X | X | |
| <i>The Conservation and Management Plan for Sarasota Bay</i> | X | | | X | | |
| <i>Critical Scientific Research Needs Assessment for the [Environmental Protection Agency] Gulf of Mexico Program</i> | X | | | X | X | X |
| <i>Ecosystem Fisheries Management: A Summary of Workshops Conducted along the Gulf Coast</i> | X | | | X | X | |
| <i>Emergency Preparedness. Future of the Region – Tampa Bay Strategic Regional Policy Plan</i> | X | | X | X | X | X |
| <i>The Estuary Compact of the Barataria–Terrebonne National Estuary Program</i> | X | X | | X | | |
| <i>Florida Sea Grant College Program Strategic Plan, 2006 through 2009</i> | | | | X | X | X |
| <i>The Galveston Bay Plan</i> | X | | | X | | |
| <i>Gulf of Mexico Alliance Governor’s Action Plan for Healthy and Resilient Coasts, March 2006–2009</i> | X | | X | X | | |
| <i>Gulf of Mexico Essential Fish Habitat Requirements</i> | | | | X | | |
| <i>Hurricane Case Study: Opal in the Florida Panhandle. Planning for Post-Disaster Recovery and Reconstruction</i> | | | X | | | X |
| <i>Louisiana Sea Grant Strategic Plan, 2002–2006</i> | X | | X | X | X | |
| <i>Marine Protected Areas Needs Assessment</i> | | X | | X | | X |
| <i>Mississippi–Alabama 2006–2010 Strategic Plan</i> | | X | X | X | X | X |
| <i>South Louisiana Recovery Survey, 2006</i> | | | X | X | | X |
| <i>A User Assessment of Coastal Ocean Observation Systems in the Gulf of Mexico. Prepared for Texas Sea Grant Program and Texas A&M University System</i> | X | X | | X | X | |

Ecosystem-Based Management

Ecosystem-based management is a strategy that incorporates the wise management of water, terrestrial, and biological resources to foster ecological sustainability. The overwhelming majority of the documents reviewed here consider impacts across such varied ecological boundaries and identify needs that require an ecosystem-based approach to management.

Water Quality and Nutrient Reduction

By far, the most documented ecological component within the literature is water quality, along with its related contributors and subsequent effects on the greater natural system. Both point and nonpoint source pollution are issues of concern along the Gulf of Mexico (Galveston Bay NEP, 1995; Barataria-Terrebonne NEP, 1996; Louisiana DNR, 1998; EPA, 2003; Jepson, 2005; Gulf of Mexico Alliance, 2006a). The scientific community often has difficulty displaying causality in waterborne pollutants, which leads to a lack of source identification. There are often deficiencies in the quality control and consistency of monitoring efforts, lack of regulation enforcement, and poor communications across management jurisdictions. There is an ever-increasing demand for freshwater resources (Galveston Bay NEP, 1995; Louisiana DNR, 1998; Jepson, 2005; Heinz Center, 2006). Freshwater diversion and flow reduction have been identified as primary challenges to the integrity of the resource (Texas NRCC, 1998; Charlotte Harbor NEP, 2000; Jepson 2005).

There is a need to improve Gulf of Mexico water quality to reduce public health risk, elevate ecosystem productivity, and enhance waterborne recreation and tourism. For many years, nitrogen yield and load have been delivered in high volume to Gulf waters (Tampa Bay Estuary Program, 2006). A 2002 study revealed that a 30 percent reduction in nitrogen load would be required to cause a decrease in the size of the Gulf of Mexico hypoxic zone (Rabelais, 2002). Other natural and anthropogenic materials of concern found in the Gulf include organic carbon, mercury, and fecal coliforms, and there are problems associated with saltwater intrusion into aquifers (Galveston Bay NEP, 1995; Sarasota Bay NEP, 1995; EPA, 2003; Louisiana Sea Grant, 2002; Jepson, 2005; Heinz Center, 2006; Tampa Bay Estuary Program, 2006).

Coastal Conservation and Restoration

Throughout the literature, coastal conservation and restoration is another issue of primary concern (Tampa Bay Regional Planning Council, 1995; Louisiana DNR, 1998; Louisiana Sea Grant, 2002; Congressional Research Service, 2006; Working Group for Post-Hurricane Planning for the Louisiana Coast, 2006). The loss or degradation of various aquatic habitats directly impacts regional economies because of issues ranging from reduced fish and shellfish harvest yields to increased vulnerability to storm events and flooding (Governor's Commission on Recovery, Rebuilding, and Renewal, 2005b). Habitat loss and major changes in the balance of freshwater and saltwater within the Gulf of Mexico ecosystem has led to a reduction of fish stocks sensitive to this balance, which in turn has led to difficulties within the commercial seafood industry (Sarasota Bay NEP, 1995).

Various coastal features are in need of restoration efforts, including wetlands, marshes, barrier islands, beaches and dunes, and nesting habitat. There are many uncertainties associated with restoration projects. To bring greater effectiveness to coastal restoration projects, efforts are needed in the areas of research, monitoring, assessment of ecosystem processes and responses, and improvement of analytical tools (USACE, 2004; Louisiana Sea Grant, 2002). In addition, there are marked advantages to communicating stories of success within the community (EPA, 2003). Investments of both financial and human resources are needed to implement needed restoration projects identified in all five Gulf states. These efforts can help to enhance biodiversity, reduce waterborne pollutants, increase commercial and recreational opportunities for coastal resources, and mitigate the impacts of storms.

Environmental Education

Environmental education is a means to improve the public's awareness and understanding of natural phenomena to foster support and positive change. The literature suggests that the Gulf Coast is an area where people need to gain a greater understanding of how their individual and collective actions affect the environment. There is a need for the greater Gulf community to acquire the skills needed to understand the consequences of actions taken on coastal resources, and become better equipped to make informed, balanced decisions. Improving public understanding of coastal ecosystem changes and impacts is identified as a top need to acquire a balance among environmental, economic, and social systems (Working Group for Post-Hurricane Planning for the Louisiana Coast, 2006).

There is a gap in public knowledge of coastal ecology and the processes to support sound management policies. While there is a common understanding that ocean and coastal areas are in trouble, awareness of ocean processes and ecology is low (Steel and others, 2005). Documented public awareness levels regarding the human impacts on ocean and coastal areas are also low. Research has also displayed a correlation between knowing about and supporting ecosystem protection and restoration (Gulf of Mexico Alliance, 2006a). It is of critical importance to demonstrate the societal value of natural resources and ecosystems to the public to nurture a greater sense of caring (Working Group for Post-Hurricane Planning for the Louisiana Coast, 2006).

Aside from informing the public, it is imperative that public administrators and coastal managers have a firm understanding of the impacts associated with ecosystem change (Lindell, Sanderson, and Hwang, 2002). It is essential for NOAA to contribute efforts toward a highly trained work force that is aware of the dynamic nature of environmental science, technology, and coastal research (Louisiana Sea Grant, 2002). With a well-informed citizenry in place, the likelihood of prudent coastal zone management decisions is enhanced.

Identification and Characterization of Gulf Habitat

Many habitat identification and characterization issues possess relevance to NOAA activities. Habitat characterization, modeling, and mapping are repeatedly referenced within the regional literature, as are ecosystem linkages among habitat, fisheries, and other living marine resources (Gulf of Mexico Alliance, 2006a; Louisiana Recovery Authority Support Foundation, 2006; Gulf of Mexico Fishery Management Council, 1998; Heinz Center, 2006). High-priority needs include better definition of critical habitat boundaries, the development of tools to monitor longitudinal change, and enhanced understanding of different habitat functions within the greater ecosystem (Gulf of Mexico Alliance, 2006b). It is also important to understand the effects of habitat alterations to quantify habitat response to both natural and anthropogenic alterations. Aside from habitat restoration in itself, there is a documented need to understand the success and functionality of such restoration projects (Morton and others, 2005). Research is needed to improve current methods, and to develop and evaluate new restoration techniques (Thayer and others, 1996). Additional data (satellite imagery, sea-surface circulation models, etc.) and additional physical measurements, such as elevation profiles, would also provide additional benefit to habitat assessment and research (Lehr and Scholz, 2002).

Coastal Hazards Resilience

As might be anticipated, many documents published since the 2005 storm season discuss the need for greater community resilience to coastal hazards. Hurricanes Katrina and Rita had significant negative impacts on the built environment, on economies, on ecological systems, and on the individuals and social networks of Gulf communities. As these communities struggle to recover, many voices in both the public and private sectors are calling for greater awareness of risks, for enhanced mitigation and response planning, and for research into what makes communities resilient to coastal hazards.

In the Gulf of Mexico, there is a continually identified need for new and innovative ways to display and communicate information to coastal communities about vulnerability to coastal hazards and appropriate responses. Effective communication of true risk can increase the resilience of both individuals and regions, and there has been substantial investment in learning how to convey such information (NOAA Coastal Services Center, 2005; Working Group for Post-Hurricane Planning for the Louisiana Coast, 2006). Developing tools that help identify key coastal areas and infrastructure at risk, using information from historical storms to communicate risk and vulnerability, and conducting environmental assessments are a few examples of current means to communicate the risk of coastal hazards (Tampa Bay Regional Planning Council, 1995; NOAA Coastal Services Center, 2002; NSTC JSOST, 2006). Despite the occurrence of numerous coastal events (storms, hurricanes, etc.) and much relevant social science knowledge of associated impacts, awareness of and preparation for hazards in coastal communities has been surprisingly limited. This is evident in the aftermath of major storm events such as hurricanes Katrina and Rita. The following sections discuss issues and needs related to coastal hazard impacts on the built environment, on economies, on ecological systems, and on human welfare.

Built Environment Impacts

The built environment, or infrastructure, primarily refers to industry and community property, such as homes, buildings, factories, bridges, roadways, levees, and other similar features (Working Group for Post-Hurricane Planning for the Louisiana Coast, 2006; Louisiana Recovery Authority Support Foundation, 2006). It is a common misperception that state and local building codes have provided adequate protection from storms. However, a primary constraint associated with the built environment is the failure for building and construction habits and practices to be sufficiently modified (Gulf of Mexico Alliance, 2006a). Both residential and commercial developers predominantly adhere to building codes and requirements; however, it is suggested that current regulations are not as effective as they could be concerning human safety and the ability of structures to withstand significant storm events. As a result, many county and local governments, such as those in Southern Mississippi, have been advised to adopt more stringent building codes and requirements to protect citizens and reduce the extent of destruction from future hurricanes and other natural disasters (Governor's Commission on Recovery, Rebuilding, and Renewal, 2005a). Additionally, federal and state agencies could offer guidance in drafting new guidelines for rebuilding standards and practices. Informed decisions and choices positively affect the rebuilding process and lead to safer, more sustainable communities.

Economic Impacts

Financial loss can be extremely high from a major storm event. Financial downturn can also come from a decline in fish stocks or reduction in water quality. Proper planning and anticipation of such events leads to a state of increased economic resilience. Significant economic loss was experienced during the 2005 hurricane season along the Gulf of Mexico. Outcomes could have possibly been more favorable if greater planning had been incorporated before, during, and after the events. In a post-Katrina survey, 2,500 Louisianans were asked what their primary needs were for recovery. Two of the top four responses were money and jobs (Louisiana Recovery Authority Support Foundation, 2006). It is also important to balance

the environmental and economic sustainability of solutions with financial constraints (Working Group for Post-Hurricane Planning for the Louisiana Coast, 2006). The literature calls for the development of economic models of consequence, resilience, and resistance (NSTC JSOST, 2006). Such data modeling efforts have the capacity to address cost-benefit issues, and market and non-market resource valuations. Industry could greatly benefit from more accurate models that predict storm track and impact (Thurlow, Kruse, and Bierling, 2004). Connecting such models to economic and social data to do “impact forecasting” could inform everything from search and rescue following a disaster to business continuity planning to prioritizing small business and housing assistance during recovery. For example, the Federal Emergency Management Agency’s Hazards U.S. Multi-Hazard tool (HAZUS-MH) is one effort to allow predictions of physical damage, economic loss, and social impacts (www.fema.gov/plan/prevent/hazus/). Because of the economic revenue that results from industries such as recreation and tourism, ports, and fisheries, it is imperative that coastal communities adopt more risk-conscious behavior to minimize hazard-related costs (U.S. House of Representatives Science Committee, 2005; Louisiana Recovery Authority Support Foundation, 2006).

Ecological Impacts

Ecological impacts of coastal hazards along the Gulf of Mexico are of particular concern. Wetland-dominated landscapes that surround human population centers are diminishing because of continual development. Such landscapes are not only important as buffers from hurricanes, but also are of great value to the larger natural system (Working Group for Post Hurricane Planning for the Louisiana Coast, 2006). There is a lack of understanding of the connection between protection and restoration of natural areas and reduced hurricane damage (Gulf of Mexico Alliance, 2006a). Steel and others (2005) speak about the need for an overall increase in the level of public understanding, referred to as the “ocean knowledge gap.” The scientific and technical complexity of many public policy matters, such as environmental issues of coastal areas and the oceans, pose serious challenges for the effective participation of citizens in the democratic process. There is a critical gap in the public’s policy-relevant knowledge. Additional identified needs are for greater-detailed maps of Gulf states to be used in selecting wetlands restoration projects, and for additional research that better defines the relationship between the hurricane flooding impacts on coastal communities and proposed restoration projects (National Academy of Sciences, 2006; Congressional Research Service, 2006).

Human Impacts

Additional measures are necessary to improve the ability to preserve human life in the wake of coastal hazards. Many of the topics previously discussed within this document affect the quality of human life. However, personal needs must be addressed. Major values and themes that emerge are safety, prosperity, cultural integrity, and inclusion and fairness of assistance during times of crisis (Louisiana Recovery Authority Support Foundation, 2006). Two human service priorities identified by the Louisiana Recovery Authority Support Foundation (2006) include mental health services and elder care services. These services were, and are, in great demand following hurricanes Katrina and Rita. When asked who was most effective in responding to these needs, recipients overwhelmingly answered local citizens, churches, nonprofit organizations, and community groups. Communicating how and where to access such services during times of need is important, and often a lack of knowledge limits public action in times of emergency. Unfortunately, enhancing the resilience of coastal communities cannot completely eliminate human pain, suffering, and loss of life, but the ability exists to reduce such impacts through careful planning that considers ecological, social, and economic factors (Smith and Deyle, 1998; Mobile Bay, 2002; Mississippi-Alabama Sea Grant Consortium, 2006).

Cross-Cutting Issues

There are two major cross-cutting themes that emerge from the literature on ecosystem management and hazard resilience. These are coordination and communication of information and the application and use of data, models, and decision-support tools. These issues go beyond the purely administrative decision-making processes to address core human values that are directly tied to safety, quality of life, and environmental health.

Coordination and Communication

Greater coordination among scientists, policy makers, resource managers, and emergency managers is needed for increased effectiveness of Gulf of Mexico coastal management. Too often such disciplines work in a vacuum with little consideration for issues outside of their immediate responsibilities. While intentions are good, too often organizational efforts are fragmented, duplicative, and possess limited coordination. Considerable amounts of research never reach managers, and agencies often have volumes of unanalyzed data. A wide range of expertise is available within the broad marine management and academic communities, and sharing knowledge and experiences could be tremendously valuable. Site managers know local contacts and resources, and have hands-on experience with different enforcement approaches, while regional and national managers may have more media experience and technical and mapping capacities.

Mechanisms are needed to identify and coordinate natural resource information, data, and technical assistance to facilitate their use. One such mechanism is the “clearinghouse” concept. The marine protected area (MPA) needs assessment calls for clearinghouses of MPA-related scientific data, as well as of researchers and experts, funding opportunities, and outreach and educational materials (NOAA Coastal Services Center, 2002). The increasing use of the Internet means that electronic clearinghouses can be very effective. However, it is important to keep in mind that different individuals prefer to access information in different ways, meaning multiple mediums must be used to communicate the existence of clearinghouses themselves and, where feasible, clearinghouse information should be available in multiple formats.

Through greater communication with regional stakeholder groups, better use of public funds and greater public good can be achieved. Once appropriate and useful public information and messages have been decided upon, it is necessary to determine how the data can be presented in a way that makes people take notice and that promotes positive action or behavioral changes. Having possession of a perfect storm-surge model does not guarantee that citizens will evacuate a hazardous area in time of crisis. Similarly, a perfect nonpoint-pollution model will not necessarily translate to Gulf residents reducing the improper disposal of motor oil from their cars. To foster ecosystem sustainability and community resilience, information needs to be packaged in an easily digestible form and presented to recipients in a way that makes them care about the issue and relate it to their own lives.

Application and Use of Data, Models, and Tools

A commonly cited limitation within the Gulf of Mexico coastal management community is the lack of accessibility to and compatibility of technical data (Gulf of Mexico Fishery Management Council, 1998; Texas NRCC, 1998; NOAA Coastal Services Center, 2002). The primary needs for data include access to, knowledge of, and training for application. As an example, the need for access to and training in how to apply geographic information system data and tools is reflected in several documents (Gulf of Mexico Fishery Management Council, 1998; NOAA Coastal Services Center, 2002; Council on Environmental Quality, 2004). The greater Gulf coastal management community would likely benefit from the sharing of best data and modeling practices. Additionally, sharing information, identifying data sources, compiling data inventories, and integrating data sets when possible would be highly productive activities.

Cooperation and partnerships for data-related activities among the federal government, state and local governments, and private organizations are needed.

Second, modeling and decision-support tools are a documented, cross-cutting need (Thayer and others, 1996; Working Group for Post-Hurricane Planning for the Louisiana Coast, 2006; USACE, 2004; EPA, 2003; NSTC JSOST, 2006; NOAA Coastal Services Center, 2002). The results of a 2002 survey conducted by the Coastal Services Center recommend the development of a number of coupled meteorological and hydrodynamic models to provide improved forecasts for wind, precipitation, currents, wave fields, inland storm surge and flooding, and biogeochemical events (NOAA Coastal Services Center, 2002). The need for further improvement of the range, prediction, and accuracy of storm forecasting, primarily related to hurricanes, is further emphasized by the American Geophysical Union (2006). Specific atmospheric recommendations include increases and improvements in aircraft observations, satellite remote sensing, evaporation and heat-exchange levels in high-wind environments, and the effects of ocean waves on the transfer of heat. Development of simulation models to evaluate fishery and habitat responses, and development of simulation models to predict habitat development trajectories for restoration were also documented as important needs (Thayer and others, 1996; EPA, 2003; Congressional Research Service, 2006; USACE, 2004; Working Group for Post-Hurricane Planning for the Louisiana Coast, 2006). Finally, the development of economic and social models of consequence, resistance, resilience, and integration are specific human modeling needs (NSTC JSOST, 2006). As the Gulf Coast populations continue to grow, such models should be built into decision-support tools for emergency and development planning.

Summary

As detailed above, the literature review component of the needs assessment revealed a variety of specific needs and issues of concern in the Gulf region. This information also helped guide subsequent components of the needs assessment, providing context for focus group discussions and targeted interviews.

Introduction to Focus Group and Interview Results

The results of the literature review helped identify areas of inquiry for both the focus groups and interviews. Participants were asked to provide input in five general areas:

- Needs to support and foster an ecosystem-based approach to the management of coastal resources,
- Needs to increase community resilience to coastal hazards,
- Data and technology needs, with a focus on geographic information system (GIS), remote sensing, and decision-support tool needs,
- Communication needs, and
- Coordination needs.

For the final two topics, input was sought on how NOAA and the Gulf Coast Services Center might best communicate and coordinate, as well as how they might foster productive coordination and communication amongst the many groups involved in coastal resource management in the Gulf.

From providing information about current conditions and efforts to identifying key constraints and needs, the individuals who participated in focus groups and interviews provided a wealth of ideas. The following sections summarize this information, highlighting those needs that were raised repeatedly by customers and partners across the Gulf states. Findings from the 2006 NOAA Coastal Services Center Customer Survey are interwoven as well. The reader will note that there are significant interconnections across the topics discussed, and some needs are mentioned more than once because of their relevance to multiple topics. Lists of the individuals who participated in the focus groups and interviews can be found in Appendices D and E, and a summary of survey findings for Gulf respondents can be found in Appendix C.

NEEDS TO SUPPORT AND FOSTER AN ECOSYSTEM-BASED APPROACH TO MANAGEMENT

“Everyone agrees we need to take an ecosystem-based approach, but how do we do it?”

“At the end of the day, growth and development is the number one issue for the Gulf.”

- Gulf Interviewees

An Ecosystem-Based Approach is Needed, but Challenging to Implement

While there is widespread agreement on the need for and benefits of an ecosystem-based approach to management, Gulf resource managers and other decision-makers need help figuring out how this can be implemented. Needs assessment participants talked about the need to look at issues holistically, but said that all too frequently the coastal community is still treating issues individually. Participants said connections need to be better understood and emphasized the need to understand how land use impacts coastal and marine resources. While there is a widely recognized need to treat issues in aggregate, from the uppermost part of estuaries out to nearshore and offshore areas, this type of watershed-based approach has proved difficult to achieve. Interviewees did mention several local-level efforts that are striving to take an ecosystem-based approach, and suggested that NOAA might support these efforts.

Specific Actions Need to Be Identified

Participants said an ecosystem-based approach needs to be defined in terms of actions that can be taken. Managers want to know how such an approach can be *implemented*. It is hard to understand what ecosystem-based management means on the ground for day-to-day actions; managers need to know how they can operationalize the concept and what specific steps they should take. To this end, training, written guidance, and pilot or demonstration projects were all suggested as ways to help. Specific training topics identified included the complexities of systems such as estuaries, a review of existing relevant modeling efforts, ways to identify signs of decline, and ways to be more proactive. Several people suggested pilot projects spelling out specific activities or “steps.” Participants said that identifying these specific actions could also have added value in that it would demonstrate to local decision-makers that change can be gradual and incremental. There is a need to identify steps that can lead to incremental change and to focus on individual decisions that people relate to in their everyday lives.

Many People Need to Be at the Table

Taking an ecosystem-based approach to management involves many issues, many disciplines and professions, and many jurisdictions. Hence, there are many players who need to be at the table. Participants emphasized that bringing all the right groups together is a central challenge of trying to manage holistically.

More Resource Management Staff Members Are Needed

While the need for funding was raised throughout the assessment, resource managers tended to highlight the need for staff members. Indeed some upper-level managers indicated they do not want additional funding without more people because they have insufficient staff members to manage the projects and funding they have now. This issue was identified as a key constraint to achieving an ecosystem-based

approach; just as habitats become fragmented, over-extended resource managers end up taking a fragmented approach to management. While management entities might like to consider parts of the ecosystem beyond their jurisdictional boundaries, these entities rarely have the staff members or other resources to do this. As much as managers would like to take an ecosystem-based approach, too often they are “going from fire to fire.”

Data, Maps, Tools, and Models Are Needed to Manage Holistically

A key constraint discussed here, and in subsequent sections of the report, is having adequate information. Participants emphasized that there are tremendous data and modeling needs to undertake a true ecosystem-based approach to management. Whether one is thinking about a particular estuary or watershed, or about the entire Gulf of Mexico, many types of data are needed. (Several individuals pointed out that data from other nations are needed to address the Gulf as an ecosystem.) Data are needed across political boundaries and jurisdictions, and tools are needed to interpret and apply the information. In particular there is a need for basic research on the nexus between human activities and impacts on nearshore marine resources, considering both land-side and on-the-water uses.

The data and technology needs section of the report provides additional information on this topic, including a list of the many types of biophysical data needed. Because socioeconomic and human use information needs were identified so frequently during discussions about an ecosystem-based approach, these needs are highlighted in this section. Some specific analysis tools are also discussed because of their particular relevance.

Socioeconomic Data

Many participants emphasized the need for socioeconomic information to inform management. Economic data were the most frequently requested type of social science information. Data are needed on the economic value of coastal and marine resources, and on the economic impact of various activities that impact these resources. From data on the recreational benefits of offshore oil and gas platforms to the fisheries values of wetlands, participants said there is a particular need for economic valuation information.

Along with economic value and impact data, there is a need for basic information on human use. Managers need information on how many people are using different types of coastal resources for various purposes, and they would like to have this information in a spatial context. While data tend to be more available for commercial uses, the need for better and more recreational data—from boating to beach use to fishing—was raised by many.

Maps, Tools, and Models

Raw data are a necessary but insufficient ingredient for an ecosystem-based approach. Maps, tools, and models are needed to analyze, interpret, and apply this information to management. Mapping of habitats, jurisdictions, and watershed boundaries were all identified as critical to an ecosystem approach. (Habitat mapping is discussed further below.) Some talked about the real power of mapping as the ability to monitor change, and in being able to “layer” other information on top to inform decision-making.

This desire to be able to make more informed decisions also drives people’s interest in analysis tools and models. Participants said there is a significant need for tools that show the connections between different components of an ecosystem, and specifically that demonstrate the impacts of different anthropogenic and natural activities on coastal waters and habitats. Tools that show these connections and that allow trend

analysis, forecasting, and comparison of possible future scenarios are in high demand. In many cases this demand is tied to concern about the impacts of future growth and development, an issue discussed further below.

Many participants also called for more and better models. Specific needs identified ranged from a Gulf-wide circulation model that includes bays and estuaries to models showing seasonal freshwater inputs, to models showing the performance of different shoreline types under different environmental conditions. As with the decision-support tools identified, participants' interest in models was frequently tied to a desire to understand how future growth and development would impact ecosystems.

Habitat Monitoring, Mapping, Conservation, and Restoration Needs

So many participants mentioned habitat-related needs that it bears special mention. In the 2006 NOAA Coastal Services Center Customer Survey, 56% of Gulf respondents identified habitat restoration and monitoring as high-priority issues, making it clear that many are working in this arena. During the focus groups and interviews, participants emphasized that monitoring and GIS mapping of habitats needs to be done at a higher resolution, more comprehensively, and more frequently to allow trend analysis. Common habitat classification across management entities and geographic areas is needed, and several participants expressed support for ongoing work in this area by NOAA, the State of Florida, and others.

Beyond mapping, participants said they need tools to assess habitat condition and then tools to combine assessments and identify priority areas for conservation, protection, or restoration. Once priorities are identified, managers need the ability to preserve or restore various habitat types in an effort to protect a complete suite of biodiversity. More funding is needed to achieve thorough biodiversity representation.

Turning to habitat restoration, a key need is for more monitoring and research on the functionality of restored habitats. Several participants identified a lack of information about the performance of restored wetlands and said there is a need for training in this area. Since restoration projects are often done as mitigation, monitoring of functionality is essential to determine whether such mitigation is "working." On a related note, there is a need for easily accessible information on restoration projects completed or underway in the Gulf region to enable the sharing of lessons learned, including information about the long-term performance of projects.

Habitat conservation and restoration also arose during discussions of hazard resilience, so habitat-related needs are also discussed in that section of the report.

Growth and Development: An Over-arching Issue with Many Associated Needs

In the 2006 NOAA Coastal Services Center Customer Survey, 61% of Gulf respondents identified growth management or land use planning as a high-priority issue, and growth and development came up repeatedly during focus groups and interviews. A number of people said this is the number one issue in the Gulf of Mexico region, and numerous participants identified it as contributing to specific resource impacts and management challenges. Individuals in each of the Gulf states emphasized development pressures and voiced concern about impacts from both coastal and upstream development. Many said there is a pressing need to better understand and demonstrate the connections between growth and coastal resource quality and quantity. Specifically, connections between upland activities and coastal impacts, as well as cumulative and secondary impacts of development, must be documented and communicated. Several participants suggested that NOAA and the Gulf Coast Services Center might help facilitate

dialogue about growth and development issues in the Gulf coastal region. The following sub-sections provide information about specific growth- and development-related issues identified by participants:

Water Quality, Impervious Surface, and Nutrients

Given that both water quality and nutrients were identified as priority issues by the Gulf of Mexico Alliance's "Governors' Action Plan for Healthy and Resilient Coasts," it was not surprising that many talked about these issues during the needs assessment. The 2006 NOAA Coastal Services Center Customer Survey had also identified water quality monitoring as a high-priority issue for over half of Gulf respondents. Concerns about water quality and nutrients were raised at multiple scales, from small estuaries and bays to the entire Mississippi River basin, once again emphasizing the need for ecosystem-based approaches. Within the general topic, many individuals talked about the issue of ever-increasing impervious surface area. There is a need to understand how impervious surface area impacts water quality, and to find ways to limit impacts. Several participants commented that tools for analyzing this issue, such as the Impervious Surface Analysis Tool (ISAT) and the Nonpoint Source Pollution and Erosion Comparison Tool (N-SPECT), are needed and useful. These tools help show why understanding the location and magnitude of impervious surface area impacts is important, and they help prioritize monitoring and management efforts.

Turning to nutrient issues, limited sewer capacity in rural areas that are now facing development pressures was identified as a key threat to water quality. Managers said they need help monitoring, anticipating, and planning for these pressures. Many researchers and managers are working on hypoxia issues in the Gulf, and there has been talk about a "nutrient budget" for the Gulf to help take an ecosystem-based approach. Finally, participants mentioned a need for continued research on the impacts of nutrients, and specifically for research into connections with harmful algal blooms. (A multiagency federal working group has been working on the issues of hypoxia and harmful algal blooms for several years now. Reports specific to the Gulf of Mexico region can be accessed at www.cop.noaa.gov/stressors/extremeevents/hab/habhrca/.)

Fresh Water Demand, Impacts of Use

Another development-related concern is freshwater supply and use. Planners are worried about whether there will be adequate, clean water to support development, and resource managers are concerned about how ever-increasing freshwater use may impact ecosystems. Freshwater inflow changes have the potential to change the habitat and species composition of estuaries, which in turn can have big impacts on recreational and commercial harvests. There is a need for planning tools to predict and plan for water use that does not compromise ecosystems. And research is needed to feed these tools, exploring connections between groundwater and surface water, and exploring how changes in salinity from decreased freshwater inflows or increased saltwater intrusion may impact both natural resources and water supplies.

Planning for the Conversion of Working Lands, Priority Areas in Florida and Texas

As growth pressures increase in the Gulf region, areas that have been working lands, used for timber and ranching for decades, are now converting to development. Rural communities are unprepared for these changes and need help planning. Along the Texas coast, for example, large ranches are being sold off, and in many cases these undeveloped tracks are in unincorporated, locally unregulated parts of counties. Similarly, in Florida, large timber operations are selling off large tracts for development. In Louisiana and Mississippi, major population shifts and migration to undeveloped areas is occurring because of Hurricane Katrina impacts. Participants emphasized both the need for planning in these areas and the need for basic land acquisition of high-priority areas with high habitat and functional values.

Because of their historically low levels of development, both the Texas coast and the Florida Big Bend and Panhandle areas were identified as key places to pursue an ecosystem-based approach, and to carefully guide development. Several participants said the Florida Big Bend and Panhandle are areas where management can still be proactive and said these areas should be priorities for mapping and monitoring and for community engagement. Similarly, participants said the large Texas coastal ranches that are sold should be priorities for planning.

Maintaining Traditional Water-Dependent Uses

A related issue of particular concern in high-growth portions of the Gulf coast is maintaining traditional water-dependent uses. Some traditional working waterfronts have already been lost, converted to residential and tourism development, and there is a desire to preserve those that remain. To address this issue, there is an *a priori* need to analyze where water-dependent uses occur, and some groups have already started to study this. Long-established fishing and seafood businesses need water access to survive but have difficulty holding on to or competing for waterfront real-estate as property values rise. Recent hurricanes have greatly impacted these businesses and compounded this trend. Planning and regulatory tools are needed, such as special zoning districts and differential tax rates. In addition, these traditional industries must increase their resilience against storms to survive long-term.

Shoreline Hardening

As more pieces of coastline develop, both along the Gulf and up into estuaries, more areas are being hardened or armored. Managers are worried about both ecological and erosion issues associated with artificial shoreline hardening and want to promote “living shorelines,” encouraging techniques such as dune restoration, oyster restoration, vegetated buffers, and stream restoration over man-made armoring solutions. Unfortunately, there is not enough information about and access to these alternatives. In some cases, property owners want to pursue ecologically minded approaches but find a dearth of information and capacity amongst local engineers and contractors. Best management practices need to be developed for these techniques that are supported by research and informed by the experience of resource managers across the country. (These specific needs identified by Gulf participants are reinforced by the 2006 National Academy of Sciences study, *Mitigating Shore Erosion along Sheltered Coasts*.) There are opportunities for achieving multiple benefits with living shoreline projects; for example, an oyster restoration project might stabilize a shoreline, enhance water quality, and provide a few oysters for harvest.

Small Communities Need Planning Assistance

Just as inadequate staff size was raised as an issue on the resource management side, participants said that small communities often do not have the technical staff they need to address planning issues. Because these communities do not have large budgets, state or federal entities could help by providing more services to these areas. Regional planning councils, state planning agencies, and state coastal management entities were all suggested as entities that could help.

Human Use Issues

In the 2006 NOAA Coastal Services Center Customer Survey, 52% of Gulf respondents identified public access as a high-priority issue. Somewhat surprisingly given this data, public access issues were not mentioned much during the focus groups and interviews. However, a couple of individuals did talk about

the need to balance access with resource protection. As mentioned above, there is a need for more data on recreational use. Boating patterns are changing in parts of the Gulf, which means there may be a need for new boating policies in some areas.

Harmful Algal Blooms: Research and Communication Needs

Interestingly, harmful algal blooms (HABs) came up during discussions of both an ecosystem-based approach and resilience to coastal hazards. Recent HAB events in the Gulf have had dramatic ecological impacts, which in turn have led to large economic impacts on the fishing and tourism industries. Managers are worried about the ability of the natural system, and specifically offshore habitats, to be resilient to repeated events.

There are both research and communication needs related to this issue. Although significant research is underway on HABs, managers cited a need for more peer-reviewed research on the relationship with watershed management, and specifically on the role of nutrients. Managers also emphasized that there must be good communication between scientists and the public, environmental groups, and commercial and industrial interests on this issue. In Florida, some mistrust has developed surrounding this issue, and this is actively being addressed by all interested parties. Participants mentioned that NOAA's HAB Bulletins are a valuable tool.

Invasive Species

The spread of invasive species is an issue of concern around the Gulf. Resource managers said there is a need for better tracking of invasive species, and ideally they would like to be able to model the spread of different species to predict when a species might be moving from one area to another. Several managers cited the need to develop remote sensing techniques that will allow more comprehensive mapping of invasive species. For example, managers in Florida would love to be able to distinguish mangrove from Brazilian pepper using remote sensing. Although many managers in the Gulf are now familiar with management techniques for terrestrial exotics, managers cited a need for training on ballast water technologies to address marine invasive species. Finally, managers talked about the need for coordination, suggesting that it would be good to have one group tracking this issue Gulf-wide.

Regional Coordination is Needed on Restoration and Sediment Management

Habitat restoration and sediment management were also issues that many participants said could benefit from regional coordination. Having Gulf-wide information about restoration and sediment management projects and regular exchange among the professionals working on these projects would be valuable. Coordination can also be an issue within individual states, with some participants citing the need for better coordination between neighboring restoration projects involving different agencies. One specific issue mentioned was the need to monitor the impacts of channel dredging. Several participants also mentioned the importance of considering geologic processes in the restoration of barrier islands.

Sediment management is also a topic where local governments are looking for support. Participants said many local governments would like information and assistance on doing beach nourishment and sediment management in the most environmentally friendly manner possible.

Education is Needed on Ecosystem Connections and Values of Ecosystem Services

Cutting across all of the specific issues identified above, participants emphasized the importance of education as a critical component of any attempt to implement an ecosystem-based approach. There is a lack of understanding about both the interconnectedness of ecosystem components and issues, and the multiple values provided by ecosystem services.

Participants said that the Gulf management community needs help communicating the benefits of ecosystem approaches to management. For example, there is a need for more and better education on the multiple benefits of restoration. On the other side, there is also a need for more education on the ecosystem impacts of development and other human activities. On the specific topic of fisheries, there is a need to provide education on the importance of nearshore habitat to offshore species. (The communication section of the report provides additional information on specific education-related needs.)

Human Dimensions Tools and Assistance Are Needed

The need for socioeconomic and human-use data was discussed above, but the assessment also revealed needs for human dimensions tools and technical assistance.

“Human dimensions involves the beliefs, attitudes, values, behaviors, and socioeconomic, demographic, and organizational characteristics of the stakeholders involved” (Jacobson and McDuff, 1998)

While awareness of human dimensions issues and social science data and tools is growing, individuals said coastal and marine managers still often are not aware of what is possible in this realm. Tools such as social assessment are generating considerable interest among managers that are applying them, but the use of these tools needs to spread. Managers also need help integrating social science data into projects and decision-making. Assistance with participatory processes and social science tools were two specific needs identified.

Need for Good Processes and, Hence, Process Training

As mentioned above, extensive, effective participation of multiple stakeholders is seen as a key component of an ecosystem-based approach to management. In the 2006 NOAA Coastal Services Center Customer Survey, when asked about use of human dimensions tools, meeting facilitation and stakeholder engagement processes were some of the most frequently used. Sixty-four percent of Gulf respondents report that they or their offices use meeting facilitation, and 61% reported use of stakeholder engagement processes. Focus groups and interviews confirmed that many organizations are conducting participatory processes, and training and technical assistance is desired. Participants said they would like training on and tools for meeting facilitation, dealing with hostile audiences, stakeholder identification, and overall participatory process design. It was also suggested that, in some situations, it would be appropriate and helpful if NOAA facilitated discussions between local officials and resource managers.

Social Science Tools

In the 2006 NOAA Coastal Services Center Customer Survey, 61% of Gulf respondents reported that they or their offices use surveys. However, only 21% said that they or their offices use social assessments. Similarly, 35% reported that they or their offices use cost-benefit analysis, while only 9% reported that they or their offices use non-market valuation. These data demonstrate that while some social science tools are now being used regularly, others may be underutilized. The need for economic tools was mentioned frequently during the assessment, with managers saying they need help applying economic tools both to understand the value of certain resources and to understand the benefit-cost ratios of different resource uses, management actions, and future development scenarios.

NEEDS TO INCREASE COMMUNITY RESILIENCE TO COASTAL HAZARDS

“So unprepared it’s hard to describe.”

“We need everything, I don’t know where to start.”

– Gulf Interviewee

Need to Define, and Identify, Specific Actions to Enhance Resilience

The two quotes above are telling. They are the first responses given by interviewees when asked about needs to increase community resilience to coastal hazards. Coastal hazards resilience is clearly a large, high-priority issue for the Gulf region, but people are not sure how it can be tackled.

Many participants said there is a need to define resilience and, more specifically, to identify what communities can *do* to become more resilient. As with an ecosystem-based approach to management, everyone seems to agree with the concept of enhancing community resilience, but people are unsure about how to implement or operationalize the concept. Decision makers in the Gulf coast region—county commissioners, local planners, coastal managers, emergency managers, private business owner, etc.—need to know what specific actions they can and should be taking. Participants suggested developing a suite of options for helping communities become more resilient, and developing a “roadmap” with specific actions for local-level decision makers.

Although there is uncertainty about how to proceed, the 2006 NOAA Coastal Services Center Customer Survey demonstrated that there is a strong desire to learn about hazards management topics. Hurricanes and flooding/inundation/storm surge were both identified as high-priority issues by over 50% of Gulf respondents, and even higher percentages expressed a need for more knowledge about specific hazards topics:

- Long-term recovery: 78%
- Risk and vulnerability assessment: 77%
- Hazards mitigation: 72%
- Response immediately after a disaster: 69%
- Risk communication: 65%
- Forecasts and warnings: 51%

Asked to rank the relative priority of these hazards management topics, “risk and vulnerability” rose to the top, with 30% of Gulf respondents listing this as the number one priority. “Long term recovery” came in second with 19% ranking this as their top priority.

NOAA Can Provide a Forum for Dialogue

Participants said there is a need for dialogue about resilience and specifically about making the connections between growth and development and resilience. The need for this dialogue is particularly pressing in regions heavily impacted by hurricanes Katrina and Rita, where decisions about redevelopment are being made every day. Because of the many stakeholders involved, and the diverse values they bring to the table, and because of the uncertainty about what to do, there has not been enough public discourse about this topic. Participants suggested that NOAA and the Coastal Services Center might be able to start the conversation, providing a forum for community/public discussions about resilience. There is a need for dialogue about appropriate or realistic levels of resilience for different

areas, and some felt that NOAA could act as a neutral party to begin discussions of alternatives, priorities, and capabilities. In parts of the Gulf less recently or dramatically impacted, managers report that both the public and local officials are reluctant to discuss hazards and suggested that outreach on the connections between growth, mitigation, long-term planning, and resilience may be needed before dialogue can take place.

Better Risk and Vulnerability Assessments Are Needed

There is insufficient information about the vulnerability of communities and resources around the Gulf, as well as about the risks faced by different areas from various hazards. Many participants cited a need for more and better risk and vulnerability assessments, and said tools are needed to help communities and resource managers make and interpret these assessments. Some talked about the need to combine specific layers of information, for example overlaying maps of infrastructure and hazardous waste sites with information about coastal resources and demographics. Others talked about the need for decision-support tools such as the Coastal Services Center's Risk and Vulnerability Assessment Tool (RVAT.) Several people said there is a specific need for spatial information on vulnerable individuals and groups such as the elderly and handicapped. The need for tools is discussed further below, but the assessment revealed a particular interest in standardized risk and vulnerability tools that could be widely applied to existing processes such as local mitigation planning and comprehensive planning.

Communication of Risk Is Equally Important

Participants emphasized that better risk assessment alone is not a solution. Communication of risk is equally—or perhaps even more—important. Not only do managers and planners need to understand true risk, but this understanding must also be communicated to all the citizens who are at risk, and in particular to the local-level officials. The individuals who participated in the focus groups and interviews said that lack of awareness of risk is a key constraint to enhancing resilience, and said outreach and education is needed across the Gulf region. The following sections detail some specific ideas about how to address these communication needs.

Raising Awareness of Existing Plans and Planning Processes

While local mitigation plans, coastal management plans, evacuation plans, and comprehensive plans incorporating risk information exist in many areas of the Gulf, there is a lack of awareness of these plans. Participants said these plans should be advertised to the public and to local groups (e.g., chambers of commerce, homeowner associations, League of Women Voters). Education on plans and planning processes and promoting coastal zone management at the local level were identified as strategies that could help raise awareness.

Consistent Terminology

While plans can raise awareness, inconsistent terminology across plans and maps is one source of confusion for both the public and local officials. The need for consistent terminology is also discussed below under the topic of storm surge.

Explain Warnings, How to Respond

Along with being confused by varying terminology, many Gulf citizens do not fully understand the various warnings that are used and are unsure how to respond. For example, participants said the Safford-Simpson scale is not well understood by the public, and too many people in the Gulf remain unfamiliar with evacuation procedures. There is a need for basic public education on both warnings and appropriate response actions. As has been pointed out before, false alarms can be harmful to public perception and subsequent response.

Visualizations

Many participants suggested using visualizations to communicate risk and vulnerability. People interviewed find visualizations to be powerful tools when doing outreach and education on a variety of topics, and said more such tools need to be developed for hazards issues. From simple signs showing predicted surge levels to complex simulations showing how different building designs hold up in storm scenarios, visualizations are needed both to show real or potential impacts and to demonstrate how different management and development activities will mitigate or exacerbate risk.

Use Multiple Methods of Communication, and Identify Best Practices

While visualization was a technique people felt would definitely have value, participants emphasized that multiple methods should be pursued, and said that communication of risk to the public needs to be flexible and adaptable. It is important to remember that some of the people most at risk may not have access to “high tech” methods. Paper, face-to-face, and electronic communication are all needed. One suggestion was for NOAA to help develop a portfolio of public service announcements on coastal hazards management. Several individuals said that primary and secondary education is the key to cultural change for preparedness and mitigation, and suggested that training teachers is essential to have a long-term impact. As multiple methods are tested, there is a need to evaluate effectiveness and to compile best practices for hazards communication.

Risk Needs to Drive Decision-Making, but Is Not Currently

While there is certainly a need for more and better understanding of true risk, and communication of that risk, participants pointed out the basic failure to apply existing knowledge, and to consistently do so. Specifically, what is already known about risk should be driving decision-making about development, redevelopment, and mitigation, but is not. There are multiple reasons why risk does not play a stronger role, with the economics of coastal development being cited by many as the key driver that overwhelms considerations of risk. Another reason mentioned by several is that flood insurance policies, the expectation of federal disaster assistance, and many other subsidies currently encourage development in hazardous areas and create unhealthy dependencies. Individuals said that while the federal Coastal Zone Management Act and some state laws about growth and hazards have the *potential* to foster more risk-based planning and development, the political will to apply these tools is missing. A final interesting reason why risk may not play a stronger role is that local governments often lack plans or authority to protect public safety in areas that will be lost to coastal erosion or that will become more exposed to the risks of storm hazards. (This was one of the most frequently raised issues during the January 2005 Louisiana Sea Grant Presidents’ Forum on Meeting Coastal Challenges.) Despite these realities, participants said there are steps that can be taken to encourage more risk-based decision-making, and these are described in the following sections.

Build Local Capacity, Help Communities Enforce Existing Regulations, and Provide Incentives

Because most decisions about development are made at the local level, there is a need to build local capacity to understand risk, to apply assessment and mitigation tools, and to adopt risk-based planning and policies. As was mentioned repeatedly throughout the needs assessment, there is a need not only to provide decision-making tools, but also to provide training and technical assistance at the local level in applying those tools.

In some cases, local governments have already adopted regulations designed to minimize and mitigate risk, but the regulations are not followed, with exemptions or variances being granted regularly. It was suggested that both oversight and support can play a role in fostering enforcement. When state-level entities provide oversight to make sure existing plans or regulations are followed, it is undeniable that such oversight will not always be welcome. But in some cases local decision makers may appreciate being able to share the responsibility for tough decisions. In addition to oversight, support can be provided to local governments in the form of technical assistance such as helping to hold public meetings, helping to review development proposals, and helping to design mitigation measures. Finally, state or federal entities can also provide support by publicly praising communities that are doing a good job.

Finally, economic incentives were identified as important tools for influencing decision-making at the local level. Just as the National Flood Insurance Program's Community Rating System and some of Florida's wind insurance rate reductions provide economic incentives for communities and individuals to take mitigation measures, other economic incentives could be developed to foster a range of activities that enhance resilience.

Training On and Evaluation of Mitigation Methods Are Needed

Another area where capacity-building is needed is in the application of mitigation techniques. Participants suggested a specific need for training of contractors and homeowners on mitigation methods at the site level as has been done in Florida by the Federal Alliance for Safe Housing. But there is also a need for training of planners and floodplain managers thinking about mitigation at larger scales. Since the effectiveness and cost-benefit ratio of various mitigation methods is still not completely understood, better methods of both qualitative and quantitative performance evaluation of mitigation after a disaster are also needed. Participants said it is particularly important at the local level for there to be a set of methods for assessing loss avoided because of mitigation actions.

Communities Need Ways to Measure Resilience, and There Is a Need for Dialog about the Social and Economic Aspects of Disasters

Going a step beyond assessing risk and vulnerability, there is a need to measure and monitor resilience. Participants said that community resilience indicators could support meaningful discussion, but emphasized that measuring resilience needs to be about more than whether a particular physical settlement "bounces back" after a disaster. Measuring resilience means thinking about the long-term ability of both natural and human systems to withstand stressors and to have lessened vulnerability over time.

It also means thinking about the economic and social aspects of communities, as well as the built environment. Many participants commented on the need for consideration and measurement of economic and social factors related to disasters and resilience. On the economic side, there is a need to show both the costs of hazard events, and the cost-benefit of various mitigation, planning, and management actions. Within the economic arena, several participants noted that insurance is a key issue, calling for insurance analyses and dialogue about public insurance policies. On the social side, the ability for communities to

stay together after disasters was raised as an important issue. This is a significant and ongoing issue across the areas hardest hit by Katrina and Rita. And in Florida and Alabama there have also been changes in community composition after large hurricanes, with different types and densities of development and new people moving into impacted areas and bringing different cultures and values. Together with rapidly rising property values, these changes create social instability. Participants said that the social and economic aspects of disasters are important and require more discussion across the Gulf region.

Maps, Forecasts, Decision-Support Tools, and Training Are Needed

Just as they reported that an ecosystem-based approach to management requires extensive information and analysis tools, needs assessment participants identified a host of information needs to support enhancing community resilience. More floodplain and surge/inundation mapping was identified as a key need, along with improved surge predictions and hurricane intensity and track forecasting. Many participants mentioned the need for pre- and post-storm data layers for comparison, and said more data are needed to help deal with spills and environmental response issues. As mentioned above, there is a high level of interest in tools that can help communities assess risk and vulnerability.

Also similar to the discussions about ecosystem-based approaches, participants emphasized that more information and tools alone are not enough. Training and technical assistance are needed to help resource managers, planners, local officials, and first responders understand the information and apply the tools. For example, the Coastal Services Center's Community Vulnerability Assessment Tool (www.csc.noaa.gov/rva_tools/) was identified as one tool that could be very useful but that communities find overwhelming without assistance through the process. The Association of State Floodplain Managers' new Coastal No Adverse Impact handbook (www.floods.org/NoAdverseImpact/coastal.asp) was another specific tool where participants said training would be helpful. Several participants said first responders need training to better understand the data to which they have access. Both first responders and local officials in areas heavily impacted by Katrina and Rita were identified as groups that cannot devote extensive time or travel funding for training; participants recommended half- or one-day offerings and distance-learning options for these audiences.

Emergency Managers, Floodplain Managers, Resource Managers, and Land Use and Transportation Planners Need to Connect

Just as there are multiple data layers required to understand risk and resilience, there are diverse professions involved in assessing risk and planning for resilience. And just as there is a need to sort out all the different maps, models, and planning efforts related to hazard resilience, there is a need to bring together the diverse professionals working with these products and processes.

Emergency managers, floodplain managers, resource managers, land use planners, and transportation managers were all identified as playing important roles in increasing community resilience, and many participants talked about the need to bring these different communities together. While they have different priorities and missions, and use different methods, people working in these different fields are all struggling with issues related to reliance. Bringing these groups together provides opportunities to share information, tools, lessons learned, and perspectives. It also provides the opportunity to collaborate, pursuing resilience-related projects that meet the missions of multiple groups. Finally, it can eliminate current and prevent future inefficiencies and duplication of effort. Participants suggested that NOAA encourage these groups to connect and provide forums for dialogue and exchange. Training on the

Coastal No Adverse Impact handbook was mentioned again, identified as one possible tool for fostering collaboration across different groups.

Post-Disaster Planning Is Needed *Before* Disaster Strikes

The need for planning before disaster events is all too apparent in the wake of the 2004 and 2005 hurricane seasons. Participants now working on recovery in the northern Gulf emphasized the need for post-disaster redevelopment planning before an event and said this is a key gap in the region. Emergency decisions need to be built into long-term planning, and information from recent hurricanes should now inform future strategies. Resources are needed to fund this planning.

Enhanced Use of Mutual Aid for Post-Disaster Support

One type of pre-event planning suggested was the development of partnerships between organizations and communities in different geographic areas of the Gulf coast. Local governments, resource management entities, and community organizations could participate in an integrated mutual aid process wherein all parties agree to provide support after large disasters. The value of such relationships for response needs through the Emergency Management Assistance Compact was demonstrated after Katrina and Rita, and participants suggested that such partnerships need to be encouraged and expanded for recovery, mitigation, and long-term planning.

Pre-Event Planning for Communication and Research Continuity Is Needed

Several individuals talked about the need to determine how communication and information needs will be met during a disaster. Again, establishing partnerships before an event can help, and identifying roles in the event of a disaster can ensure that communication channels function and that critical information is saved or collected. Participants also talked about the need to plan for preservation of monitoring data. For example, oil production platforms provide for extensive monitoring. There needs to be a plan for when an offshore platform has to shut down for evacuation. Plans are also needed for re-establishment of monitoring capacity after a disaster.

Business and Employment Continuity Planning

Participants talked about the need for planning for businesses and for workers. For the oil and gas industry, hazards planning is clearly a big issue; not only does the industry have extensive infrastructure in the Gulf region with offshore platforms and land-based pipelines, but many of the industry's employees also live in areas likely to be impacted by coastal hazards. The recreation and tourism industry is another sector that could benefit from predisaster continuity planning, and participants said there has been inadequate dialogue with this industry about this topic. Finally, the fishing and seafood industries are particularly vulnerable to coastal hazards, and could benefit from planning. One idea suggested is for states or even the entire Gulf region to develop plans for how fishermen and seafood workers displaced by either a storm or a red tide could be employed temporarily in other areas or sectors, perhaps helping to rebuild after a storm, or helping to study the storm or red tide impacts on habitats and species.

There Is Confusion about Storm Surge Models, and Basic Education and Outreach Are Needed

Storm surge was a topic raised by many participants, the majority of whom remarked on the confusion generated by the various models and mapping efforts related to surge. The scientific debates and variations across different models are confusing to the public and to local officials. There is a significant need for education and outreach on surge as a critical component of risk communication, but the current confusion hampers communication efforts. Participants called for standardization of both surge modeling and mapping, saying that the various entities involved in modeling and mapping need to agree on and implement standards that are based on accurate heights and horizontal positions. New outreach and education materials need to be developed, and once again visualization was identified as an effective technique for helping people understand surge.

Better and More Surge Modeling

A number of participants also discussed data needs that could improve surge modeling, specifically wind data, upland topography/elevation, and bathymetry. As is mentioned in the data and tools section, several participants expressed a need for seamless topographic-bathymetric elevation models to increase the accuracy of surge modeling. Finally, there is an interest in having more runs of the SLOSH model, and specifically having runs 48 hours out to inform local decision-making.

Sea Level Rise Research, Education/Outreach, and Planning Are Needed

Sea Level Rise was another topic raised repeatedly during discussions of resilience, and participants said there is a growing recognition of the need for research on and education about sea level rise. On the research side, there is a need to understand the different causes of sea level rise and the relative contributions of these causes. Participants suggested more sensors to allow more precise tracking, especially in areas that are most vulnerable. Predictive models showing ecological and socioeconomic impacts are also needed.

On the education side, there is a need to raise awareness in coastal communities that sea level rise is happening and that planning is necessary. Outreach efforts need to identify the connections to growth and development and demonstrate the value of proactive action. Participants said that information about long-term costs is an essential component of communicating about sea level rise; people need to be able to consider the costs of various adaptation and mitigation strategies. For example, retreat might be more expensive than coastal armoring in the short-term, but ultimately may be more cost-effective.

As with the overall topic of resilience, sea level rise is an issue that both resource managers and elected officials find hard to address. Participants said that states are starting to worry about sea level rise and recognize the need for planning, but they do not know what should be done. There is a need to identify options and strategies and to communicate projections that make the issue more real for the communities most at risk.

Habitat and Wildlife Impacts

While much of the discussion of sea level rise focused on impacts to human communities, participants also talked about impacts to coastal habitat and wildlife. Many Gulf species stand to be impacted by rising sea levels, and research and planning are needed to help sustain both individual species and biodiversity. Sea turtles, beach mice, and shorebirds are a few of the more charismatic examples, but numerous coastal species will be impacted as habitats change.

Restoration Projects Need to Plan for Sea Level Rise and Climate Change

Resource managers are also concerned about how sea level rise and climate change will impact restoration efforts. Managers recognize the need to plan for these factors as they design projects, and some are already thinking about how buffer areas can be included in projects to allow habitats to migrate landward in the face of storm surge and sea level rise. Managers said they need guidance and case studies to inform their efforts in this area. A guide on how to incorporate resilience in coastal restoration would be a useful tool in the Gulf region.

Protect and Restore Coastal Habitats, and Communicate the Hazard Mitigation Values

Since hurricanes Katrina and Rita, people across the Gulf region, and indeed across the country, have been talking about the importance of coastal wetlands for mitigating storm damage. Not surprisingly, the assessment identified a need to pursue habitat restoration and protection to achieve both ecological and hazard mitigation benefits. Participants also said there is a need to better understand the connection between coastal habitats and hazard risk. Tools are needed that show the relationship of wetlands to flooding and storm damage. As with other topics, including economic information within these tools is important, allowing people to understand and communicate the economic costs and benefits of wetland loss and restoration.

In Mississippi, the state has worked with the Nature Conservancy to combine information about storm-affected areas with information about areas of environmental importance. Places where there is overlap have been identified as acquisition priorities. This methodology could be extended around the Gulf, and identifying these “win-wins” could help generate support for protection and restoration in these areas.

Katrina and Rita are Not “Over”

A final and important note under the resilience section is that hurricanes Katrina and Rita continue to impact thousands of people in the Gulf of Mexico region. Impacts to the natural system also persist. Cleanup of waterways and estuaries continues, and NOAA’s work in this area is appreciated and needed. Participants emphasized that there are still basic recovery needs, as well as unanswered questions about where displaced people can and should go.

DATA AND TECHNOLOGY NEEDS

“The technology side is where NOAA could really shine.” – Gulf Interviewee

As the above quote suggests, many of the people who participated in the needs assessment look to NOAA as a valued source of data and technology tools. While existing data and tools from NOAA and its partners are widely used, there are also many additional needs. Some of these needs were identified as specifically related to an ecosystem-based approach to management or resilience to coastal hazards and have already been introduced. This section augments that information, providing more details on both the types of data and tools currently used, as well as gaps and constraints to use and application.

Survey Results: Current and Desired Spatial Data Use

The NOAA Coastal Services Center Customer Survey provided insight into both current and desired use of spatial data. The most commonly used spatial data layers among Gulf respondents were current shoreline, coastal land cover, and coastal land use, with 70% or more of respondents’ offices using these layers. Additional data layers being used by over 50% of respondents’ offices were seagrass distribution, public access, and elevation/topography.

The survey also revealed data needs, with over 50% of Gulf respondents indicating that the following layers were not currently being used but would be useful:

- Sediments
- Suspended sediments
- Waves
- Currents
- Tides
- Shoreline change/erosion
- Coastal demographics
- Marine and coastal economic data
- Marine infrastructure
- Critical facilities
- Dump/discharge sites
- Aquaculture sites
- Salinity
- Sea surface temperature
- Primary productivity
- Fish habitat distribution maps
- Shellfish bed distribution
- Cultural and historical resources
- Sensitive habitats

Detailed Data and Mapping Needs

Augmenting the survey results, the focus groups and interviews identified a host of specific data and mapping needs. While it is clear that the amount and use of coastal and marine data has grown dramatically in recent decades, there are still big data gaps in the Gulf of Mexico region. The following list attempts to summarize the range of needs expressed:

- Data in a GIS format: There is an ever-growing demand for data that can be viewed and analyzed in GIS.
- Habitat mapping: As discussed in the ecosystem-based approach to management section of the report, habitat mapping was a frequently identified need. Specific types of habitat mentioned included hardbottom, oyster reef, wetlands, and submerged aquatic vegetation (SAV). Participants also said areas need to be mapped more frequently so change can be monitored. There is an interest in having more side-scan data.
- Bathymetry and topography/elevation data: Many individuals mentioned the need for more bathymetry data. In addition to a basic lack of bathymetry in some areas, much of the data currently available are significantly outdated. There is the potential to do concurrent identification of habitat types when collecting bathymetry data. Lidar data are needed for elevation, and there is a need to integrate bathymetry and topography data sets, creating seamless “topo/bathy” maps. This integration is needed to understand and model processes that occur across the land/water interface, such as how activities on land impact coastal waters and in modeling surge and inundation from a storm. VDatum was identified as an important tool for transforming coastal elevations between different vertical datums.
- Remotely sensed data for habitat mapping: Participants emphasized the need for remotely sensed data sets with a high resolution to support habitat mapping and said they are always in need of and interested in more recent aerial photography. In particular, resource managers are interested in low-tide and winter photography to better map oyster beds and seagrass.
- Species associations with habitat: Once habitat is mapped, there is a need to identify species associations. (This was mentioned under the topic of fisheries data as well.)
- Historic habitat mapping: In addition to current data, managers are interested in having pre-development habitat information in a GIS format. Historic benthic maps and pre-development vegetation maps allow managers to assess changes in habitat structure.
- Land use and change over time: Current and trend information on land use are needed for a variety of applications, including restoration planning, growth management, and evacuation planning.
- Sediment transport data and lidar: Participants cited a need for these data to help with monitoring both beach nourishment projects and channel dredging. The combination of topographic lidar for beach surveys and modeling of sediment transport can help managers understand how long a nourishment project will last and where the sand is going. Along with the need for data, participants also mentioned there is a need for coastal geologists to provide expertise to inform restoration efforts.
- Data from water level stations and NOAA buoys: Participants said that more water level stations are needed, and more buoys are needed to provide improved wind, wave, and current data.
- Surface radar measurement of currents: Participants called for greater frequency of measurements.
- Oil and gas infrastructure and impacts: There is an ongoing need to track both the number and location of oil and gas rigs, and to identify and locate associated infrastructure. One specific problem mentioned was that maps showing pipelines coming in from offshore do not match up to maps of onshore lines. Participants also identified the need for data on the impacts of outer-continental shelf exploration and development on wetlands, considering variables such as navigation channels and vessel traffic.
- Real-time data systems for marine transportation: One participant talked about the need to expand PORTS data beyond water level. Oil spill trajectory, pH, and salinity were all mentioned in this context.
- Hydrography: Much of the hydrography for coastal waters in the Gulf is 50 or even 100 years old. Restoration projects, surge models, coastal engineering, and coastal research projects all use these dated surveys and could benefit from more recent information.

- Benchmarks for surveying: Many of the benchmarks and survey monuments in the northern Gulf were destroyed by Katrina. New and accurate monuments are needed. (NOAA and other partners have been working to address this issue since the storm.) Accurate land surveying is critical to research.
- Data for performance measures: Many resource managers are being asked to collect data for performance measures. State coastal zone management programs are struggling to pull together all the data for their performance measures, some of which are not readily available, and could use help with this task.
- Flood and wind frequencies: These data are needed at the local level, along with historic precipitation and tide data.
- Social vulnerability: Several participants expressed interest in having social vulnerability assessment data in a geospatial context.
- Pre- and post-storm data: There is a critical need for before and after aerial photos, elevation surveys, and other remote sensing data to evaluate storm impacts such as erosion and debris. More data points for high-water marks are also needed.
- Marine debris mapping: Several individuals mentioned the ongoing need for marine debris mapping.
- Human use maps, economic data: As discussed in the ecosystem-based approach section, many participants talked about the need to collect data on human use as well as a variety of economic data. Beach use, boating, and recreational fishing were mentioned specifically as human uses that managers would like to see in a spatial context.
- Fisheries data: Fisheries-related data needs were discussed, including more stock assessments, fisheries utilization and distribution data, and essential fish habitat refinement. Participants are interested in more real-time data, and a number of participants emphasized the need for better data on recreational fisheries.
- Hypoxia data
- Salinity monitoring for drinking water applications

Data Management, Access, Sharing, and Standards

More coordinated data management, improved data access, increased data sharing, and data standards were topics mentioned repeatedly during the assessment. This is not surprising, given the variety of entities collecting data in the Gulf of Mexico region. Several participants felt that NOAA and other federal agencies should play a key role in helping to address these needs, saying that federal entities could provide value in the region by pursuing cross-database management and actively fostering improved data access, sharing, and management. Some indicated it is part of the federal mission to provide a trusted data repository. The state of Florida is currently pursuing enhanced coordination of coastal and marine data and would like to coordinate with federal efforts. Although participants felt federal entities were poised to help, several individuals acknowledged that there are problems with data sharing even among the federal agencies.

Regarding standards, participants spoke of the need for more standardized data collection and quality-control protocols, and for more standardized metadata. Fostering standardized metadata is an area where federal entities are seen as important players. (The multiagency Federal Geographic Data Committee, which promotes geospatial data coordination, provides a variety of metadata resources: www.fgdc.gov/metadata/.) Several participants talked about the need for increased standardization of water quality data, calling for consistency across monitoring efforts by different agencies and programs.

On-line Databases and Clearinghouses

Resource managers, researchers, and others said a key challenge is simply finding out what data exist in the Gulf region. Accessing data is a secondary challenge. Participants suggested there is a need to develop regional and/or national on-line databases and data clearinghouses for a variety of data types. Remote sensing imagery, sediment management data, bathymetric data, and restoration project information were four specific areas where individuals felt clearinghouses are needed. Several participants expressed support for using the portal concept for Gulf Coast imagery and other data.

Consult the Locals When Building a National or Regional Database

Sometimes regional/national databases do not provide information that is useful at the local level. In other cases the databases might be useful but have not been designed with local users in mind and thus are hard to use at this level. These problems are understandable since regional/national databases are often designed for a national target audience. While answering national questions for audiences such as Congress clearly has utility, there is the potential to enhance the benefits of such databases if locals are consulted during development.

State and Local Entities Have Data to Contribute

Another reason to consult both local- and state-level partners is that there are significant data holdings at these levels, as well as capacity to collect new data. Several participants talked about specific data they would like to share. For example, the Alabama Department of Environmental Management has a Cessna plane with several sensors and cameras, and they would be interested in sharing the data they gather with NOAA and comparing remote sensing data. The National Estuarine Research Reserves are also a great resource for data, and these entities are interested in increased data sharing. The Santa Rosa Island Authority also expressed interest in sharing aerial photos, demonstrating that many local entities may be potential partners.

Databases and Clearinghouses Will Not Necessarily Solve Access Issues

Participants emphasized that while databases and clearinghouses are needed, *how* these tools are developed is important, and people may need technical assistance both to contribute information and to access and apply these tools at the local level. Metadata training can help data providers develop and share contextual information that is essential to data users. Once multiple data sets have been compiled, tutorials on how to find, extract, and manipulate data are needed. Organization of data is also a key variable to facilitate access and application. For example, participants suggested that data need to be organized by both political boundaries and ecological boundaries (e.g., estuary or watershed). Easy downloading of data into formats that end users can manipulate is also essential.

Integrated Ocean Observing System Data

Discussions of data management, access, sharing, and standards frequently included a reference to the ever-increasing volume of data from the Integrated Ocean Observing System (IOOS). The 2006 Coastal Services Center Customer Survey revealed that observing data are already widely used in the region, with 57% of Gulf respondents reporting that they or their offices use coastal and ocean observations. As the data needs sections above illustrate, there is a strong demand for observation information. Focus groups and interviews revealed, however, that regional customers and partners are concerned about management

of observation data. The sheer volume of real-time data from multiple ocean observing platforms has people concerned, and participants emphasized the need for planning. Individuals also talked about the need to connect observation information to management issues and to conduct outreach about the value of observation data. Finally, participants urged NOAA to consider and plan for how IOOS Regional Associations fit into NOAA's structure, planning, and projects.

Data Are Good, but Tools to Analyze Are Better

Gulf customers and partners expressed a need for a wide range of tools to analyze and apply raw data. Tools are needed both to support decision-making and to educate. Participants pointed out that one critical value of analysis tools is to explain and/or justify decisions. Tools are needed to analyze past trends, to forecast future conditions, and to model potential future scenarios. Participants talked about the need for priority-setting tools (e.g., tools to identify restoration priorities), enforcement tools (e.g., aerial photography to identify regulatory violations), and participatory tools (e.g., user-created maps of human use). As was discussed in the ecosystem-based approach section of the report, tools to demonstrate the cause and effect relationship between growth and development and coastal resource quality and quantity are a priority need.

Survey Results: Current Tool Use and Constraints to Use

The 2006 Coastal Services Center Customer Survey provided information on Gulf respondents' use of various technology tools, as well as the most common constraints to use. The most frequently used tools are as follows:

- **GIS:** This is the most widely used tool, with 91% reporting that they or their offices use this technology.
- **On-line data and mapping:** 77% reported that they or their offices use on-line databases such as portals and clearinghouses, and 75% reported use of on-line mapping for browsing or viewing data.
- **Visualization tools:** 64% reported that they or their offices use visualization tools.
- **Remote sensing:** 60% reported that they or their offices use remote sensing tools.
- **Decision-support tools and models:** Use of analysis and modeling tools is widespread, with 56% reporting that they or their offices use decision-support tools for manipulating or analyzing data, and 43% reporting that they or their offices use models or model outputs.

When asked about constraints to using technology tools, Gulf respondents indicated that conflicting demands on time, lack of required knowledge or skills, and insufficient staff size were key constraints to using technology tools. For on-line databases, on-line mapping, coastal and ocean observations, and decision-support tools, conflicting demands on time was the top constraint. However, for GIS, remote sensing tools, visualization tools, and models, a lack of required knowledge and skills was the top constraint.

When asked about the utility of various types of assistance with technology and data, four types of assistance were identified as having high utility by over half of Gulf respondents:

- Providing data (73%)
- Providing training on existing software (71%)
- Providing on-site technical assistance in use of software (59%)
- Developing customized applications (53%)

The interest in training and on-site technical assistance was reiterated by many during the focus groups and interviews. As the next section discusses, when it comes to technology tools, participants felt strongly that effective delivery is just as important as development.

Tool Delivery Must Promote On-the-Ground Application

Developing an on-line tool for analyzing land use trends in the Gulf region does not guarantee that all Gulf communities will understand how they are growing. Creating the perfect storm surge model does not mean everyone who should evacuate will or can. And creating the perfect nonpoint pollution model does not mean that people will stop dumping oil in their driveways.

These examples demonstrate a concept expressed repeatedly during the needs assessment: developing a tool is only “half the battle.” Again and again participants emphasized that more effective delivery of existing and future tools is essential to promote on-the-ground application, and ultimately to promote policy and behavior change.

More effective delivery is a two-part challenge. First, there is a need to get the tools in the hands of coastal communities. Second, these communities need both the capability and capacity to *use* the tools. Participants said that existing tools are not being used at a scale broad enough and big enough to matter, and said better delivery is essential both to an ecosystem-based approach to management, and to enhancing community resilience.

Basic Outreach Is Needed to Reach New Audiences

Outreach is needed to address the first challenge of getting tools in the hands of those who can use them. Participants who are familiar with the Coastal Services Center said that its information and tools need better exposure to a broader group and said outreach should be broadened to reach new audiences such as planners and building permit officials. (More information on specific target audiences is presented in the communication section.)

State Partners Need Help with Outreach about Their Tools

State-level participants said state entities frequently have developed tools that are underutilized within their own states, let alone in other parts of the region that might benefit from these tools. These entities need help exporting and marketing the decision-support tools they have developed. In particular, they need help getting state tools to the county and parish level.

Training and Technical Assistance Are Needed

Participants at both local and state levels emphasized the need for training and technical assistance to help customers apply existing tools. As the data sections illustrate, both GIS and remote sensing are now used widely, but there is an ongoing need for training on these technologies. Individuals who had attended or sent staff to the Coastal Services Center’s GIS and remote sensing trainings said these were very useful and should continue. Upper-level managers expressed a need for GIS training opportunities for new staff members, and those using GIS and remote sensing already expressed a need for advanced training. A number of participants expressed a need for opportunities that allow participants to receive technical assistance from experts as they apply GIS and remote sensing data to their local issues.

Beyond GIS and remote sensing, participants mentioned training and assistance needs in a variety of technical areas, from 3-D modeling and visualization tools to metadata and statistical packages. There is also interest in training on new and emerging technologies such as Web Services.

Finally, a number of participants commented on the need for training and technical assistance specific to Coastal Services Center tools. ISAT, NSPECT, and CVAT were all identified as tools that require training and technical assistance. Participants said these tools are very valuable for Gulf customers, but urged the Center to explore ways to make these tools easier to use.

Tools Should Be Transferable and Kept Up-to-Date

There is a constant tension between trying to ensure that a tool is locally relevant and trying to create tools that are widely applicable. Participants emphasized the need to strike this balance, making tools transferable while not losing their local utility. Several also mentioned the need to make sure that tools that use Environmental Systems Research Institute (ESRI) technologies are updated as new versions are released.

Remember, Not Everybody Is a “Techie”

As a closing note on data and technology needs, and one related to the next section on communication, participants urged NOAA to remember that not everyone can access and use highly technical tools and “e-products.” While technology tools are clearly needed to address many of the issues raised in the assessment, several participants talked about the importance and value of “low-tech” tools. While computer-assisted analysis is useful in many settings, basic graphics, and face-to-face explanation of concepts, still have tremendous value.

COMMUNICATION NEEDS

“Communicate what all of NOAA can do.”

“The Coastal Services Center should help match up NOAA resources with users on the ground.”

“A key challenge in the Gulf is knowing who’s doing what.”

“It will be great to have a regional Center in the Gulf.”

-- Gulf Interviewees

The above quotes illustrate ideas heard repeatedly during the needs assessment. Participants provided positive feedback on existing NOAA and Coastal Services Center products and services but said there is inadequate awareness and use of these products. Resource managers and others are overwhelmed by information, and need help tracking the activities of the many entities involved in coastal and marine management in the Gulf of Mexico. A Gulf Coast Services Center that strives to connect NOAA products and services with on-the-ground needs, and that fosters communication and coordination among Gulf players, will be a welcome addition to the region.

Survey Results: Use of Different Communication Mechanisms

The survey revealed that Gulf respondents use a wide variety of communication mechanisms to exchange information related to their jobs. The following list shows methods used by at least half of respondents, listed from most to least used:

- Talking with colleagues (100%)
- Professional meetings and conferences (93%)
- Workshops (91%)
- Trainings (85%)
- Websites (81%)
- Technical documents, government reports, conference proceedings (73%)
- Scientific journals (67%)
- Newsletters (63%)
- E-mail discussion groups (list serves) (53%)
- CDs (53%)
- Private sector relationships (51%)
- Books (51%)

COMMUNICATION BEST PRACTICES

While the needs assessment focused on identifying gaps and constraints, interviews and focus groups also provided insight into best practices for communication when participants highlighted products and services they have accessed and appreciated. While there are clearly large gaps and challenges, the following sampling of raw comments identify some things that are working. In some cases participants also suggested ways to improve these mechanisms to better address current needs.

NOAA Products and Services

- Websites, conferences, and e-mail newsletters from NOAA are all used.
- I'm very pleased with river forecast and hurricane data.
- Sea Grant extension agents are helpful.
- The news around the Gulf piece from the Office of Ocean and Coastal Resource Management is useful.
- I like the Gulf of Mexico Alliance working website.
- NOAA websites have a lot of information, but sometimes the information is dated.
- The Environmental Protection Agency relies on NOAA data.
- The Community-based Restoration Program provides very useful information.
- The Community-Based Restoration Program has accomplished a lot at the local level. It's an effective program. If given funding, it could do lot of good things at the local level.
- The Coastal Risk Atlas is very useful, although I sometimes think it could be more user-friendly.
- I get information from the National Coastal Data Development Center (NCDDC) at Stennis.
- I use the National Data Buoy Center (NDBC) and National Hurricane Center (NHC) websites.
- NOAA remote sensing resources are useful.

Products and Services Specific to the Coastal Services Center (CSC)

- The Project Design and Evaluation (PDE) and Public Issues & Conflict Management (PICM) trainings were well-received. We're very impressed with Center trainings.
- GIS training is good. Keep it coming.
- Facilitation assistance we have gotten is good. Keep it coming.
- I really like being able to call for help with identifying speakers and for help with meeting process planning.
- I call staff directly that they're very accommodating and glad to help.
- Continue doing things CSC already does well—good customer service response, data, and workshops.
- CSC websites are useful, but things can be hard to find.
- We really like the NSPECT tool and have used it widely. These remote tools for water quality management and sampling are of great appeal and need.
- Tools such as NSPECT and CVAT are needed, but we need help applying them.
- We're using Coastal Change Analysis Program (C-CAP) data and the ISAT tool.
- I use the CSC website often to access products.
- CSC has workshops that are very useful. We've already taken advantage of this. Bringing professional development opportunities is great.

Customers Need Help Tracking Gulf Activities and Entities

The diversity of communication mechanisms used by Gulf respondents hints at the “information overload” many are facing. Many participants spoke about the challenge of keeping track of who has

what when it comes to data, tools, and services, and of keeping up with who is doing different projects. Resource managers know there are additional resources they could benefit from, but they do not know where to go, and they do not have time to spend hunting for these resources. Unfortunately, this lack of awareness also leads to duplication of effort. For people on the ground there is a real need for mechanisms that sort through all the varied activities and resources in the Gulf region.

Develop Roadmaps and “Push” Products

Many participants said there is a need for “roadmaps” or guides for locating data and tools that will help people at the state and local levels. Some individuals said that just having a guide or catalogue was not enough, however, and suggested that NOAA and other providers of information and tools should do more active outreach. These individuals suggested “pushing” products via mechanisms such as periodic updates on data, tools, and training, and annual reminders. The following sections summarize specific products and mechanisms that participants said were needed or could help customers and partners track activities and products.

Gulf Coast Services Center E-Newsletter

Many participants suggested a newsletter, and the majority recommended an electronic format shared via Listserv. Federal, state, and local entities all indicated a newsletter could be useful. Most suggested this newsletter cover specific products, although some also suggested it contain information about ongoing projects. Participants emphasized that such a newsletter would need to be targeted, and concise. Recommendations for frequency varied, with some suggesting a monthly newsletter while others said every few months. It is important to note that several participants advised against the creation of a new newsletter, citing existing information overload.

Gulf Websites, Calendar of Events

As was mentioned in the data section, there is a need for regional on-line databases, and websites were mentioned as a useful tool for information sharing. However, participants cautioned that websites can be daunting to navigate through, and recommended making sites searchable by keyword. Creating a website also means committing to keep it up to date. Participants suggested that providing downloadable one-page summaries of information on websites is useful.

Several people suggested there is a need to develop a calendar or schedule of all activities in the region. One participant said it would be helpful if such a product were designed so that receiving entities could filter out the items they are interested in before sending on to additional partners, and so that entities could add their own events.

Gulf Coast Services Center Staff Members Should Serve As Regional Points of Contact

Needs assessment participants were pleased to learn that there would be Gulf Coast Services Center staff members who can serve as regional points of contact. They indicated that it would be useful to have such contacts both for accessing Coastal Services Center products and services and for accessing products and services from the broader NOAA family. Because NOAA is so large, individuals often do not know who to call about a particular topic, and several participants said it would be great to be able to call a local, familiar source. There is a need to have points of contact who understand local conditions and players, and a Gulf Center can provide this function.

Meetings, Calls, and Presentations

Even those individuals who suggested newsletters and websites frequently said that there is no substitute for direct communication. Many participants recommended meetings and workshops for sharing information as the Gulf Center joins existing or creates new networks in the region. Several entities said they would appreciate face-to-face meetings to get to know the new Center. Participants said NOAA should continue to provide information at conferences, and some suggested the new Gulf Center support regular forums for information exchange in the Gulf region. Participants said that when face-to-face communication is not possible, conference calls can be valuable.

Outreach Is Needed on the Full Suite of NOAA Capabilities and Assistance

Perhaps the most frequently voiced communication need was for outreach on the full range of NOAA information, products, and services. Participants said both current and potential customers and partners are unaware of the full suite of NOAA capabilities. Both state- and local-level entities are unaware of NOAA information, products, services, and funding opportunities that could help them, and even customers who do take advantage of some of what NOAA has to offer say that they need to know more about the capabilities and assistance in parts of NOAA with which they are less familiar.

Both private and public entities said they would like to have one place where they can go to see everything NOAA has to offer and everything NOAA is doing. Participants said there is a need for outreach materials on NOAA's capabilities and resources and said NOAA needs to do a better job communicating what all the different divisions do. Finally, several individuals pointed out that the lack of awareness about the range of activities means that states and municipalities do not realize how many resources they are getting from NOAA. Making the connections across NOAA programs would create a clearer picture of the NOAA contribution.

Regional Team Contribution

In the fall of 2006, NOAA established eight regional collaboration teams composed of representatives from all of NOAA's line offices and programs. This needs assessment has been shared with NOAA's Gulf of Mexico Regional Collaboration Team to promote outreach and communication of NOAA's products and services in a highly integrated way that more directly meets the needs of the Gulf stakeholders. This needs assessment was also reviewed by the NOAA regional team in developing collaboration goals and projects for the first year.

Gulf Coast Services Center Should Match NOAA Tools with On-the-Ground Needs

In addition to calling for greater outreach, participants said a key role of the new Gulf Coast Services Center should be to match NOAA tools with needs on the ground. The Gulf Center should continue to assess needs, as is being done in this assessment, and foster connections between NOAA programs and regional customers and partners. Participants suggested it would be helpful if the Gulf Center could also communicate about planned projects where there might be opportunities to "piggyback" and stretch limited dollars. For example, there might be monitoring activities where a state or local partner could add a little funding and have an additional sampling area or additional criteria included in the project.

Customers Need Help Promoting the Value of Management and What They Have to Offer

Not only is there a need for more outreach on what NOAA has to offer, but customers and partners in the Gulf region also say they need to do a better job with outreach about their own activities. Several participants said coastal resource management entities need help promoting themselves and what they do and suggested that NOAA could help them communicate the benefits—and avoided costs—of management. Given funding constraints, resource management entities rarely have adequate resources for sharing and marketing what they are doing. This means there is not as much “tech transfer” and sharing of success stories and lessons learned as there could be. These entities also need help getting the word out about resources they have to offer to educators, researchers, and the public. For example, individuals with National Estuarine Research Reserves said they need help getting the word out about the reserves as research sites and about their educational facilities.

Science Translation Is Needed

In discussions of communication needs, participants emphasized the need for providing information that can be easily understood by the public and other non-scientist target audiences. Whether discussing information from NOAA or from Gulf groups involved in research and management, individuals said there is a need for more science translation. Research findings need to be repackaged in ways that local governments, citizen groups, and the public can understand and apply. Graphical representations of scientific information are needed, since different people learn in different ways, and individuals said that maps are a particularly valuable tool for science translation. Terminology is also important. (For example, one individual reported that “drainage” has proven more effective than “stormwater management” when communicating with local officials.)

Target Audiences

In addition to calling for more education and outreach to the public, needs assessment participants also identified a number of specific audiences that NOAA and the Gulf Coast Services Center need to target, or help partners to target. Participants identified the following audiences:

- **Local elected officials:** This audience was one of the most frequently mentioned, with participants emphasizing the need to provide both information and tools. One individual suggested providing training for local officials when they are first elected, and several suggested getting on the agenda of meetings and making information available to staffs.
- **Planners at all levels:** Participants identified local, regional, and state planners as target audiences, again saying these groups can benefit from both information and analysis tools.
- **Permitting offices:** While some entities involved in permitting activities that impact coastal resource are already well-connected to NOAA, participants felt there was a need to reach out to state and local permitting offices that have not been traditional target audiences.
- **Communities and coastal residents:** Several people mentioned the need to reach out not only to elected officials or decision-makers at the local level, but also to their constituents. Participants said coastal residents need information to learn about the place where they live, about management, and about how to participate in decisions about the future.
- **Developers, contractors, and engineers:** Several people suggested that groups involved in designing and constructing new development are potential target audiences. For example, these groups might use information about living shorelines and pass it along to property owners. Participants said NOAA data could be useful to the coastal engineering community but felt that this audience may not know the data are available.

- Temporary residents and residents that are new to the coast: Temporary residents such as seasonal “snowbirds” and new residents from inland areas were also discussed as target audiences. Participants said these groups have low levels of understanding of the coastal resources, issues, and management entities in their new or temporary homes.
- Retirees: Several individuals talked about the retirement community being a great source of volunteers for resource managers and educators. Retirees can help with a wide range of activities, from collecting monitoring data to doing education to providing basic staff support.
- Media: A final target audience identified was the media. Print, broadcast, and on-line media can help spread information from NOAA and partners.

Existing Mechanisms, Facilities, and Partners Can Help with Communication

During discussions of communication needs, many participants reminded the needs assessment team that NOAA and the Gulf Center should take advantage of existing communication mechanisms. They also emphasized that partners in the Gulf region can help with everything from hosting workshops and training, to sharing information via existing Listservs and newsletters, to convening multiple stakeholders for participatory processes. The following list of raw comments provides examples of specific suggestions for capitalizing on partner resources and capabilities:

- Take advantage of the National Estuarine Research Reserve Coastal Training Program.
- Make use of the Gulf of Mexico Alliance Environmental Education Network and its Listserv.
- The Mission Aransas National Estuarine Research Reserve can be used as a field training facility.
- The State Geodetic Advisors are working constantly to coordinate activities not only among federal agencies but also between federal, state, and local agencies.
- Take advantage of existing computer labs.
- Do not build new systems to communicate, but rather participate and integrate with existing ones such as National Estuary Programs, National Estuarine Research Reserves, emergency managers, floodplain managers, etc.
- Think about the Dauphin Island Sea Lab as a potential partner. The lab hosts conferences and trainings, and the new National Marine Fisheries Service lab will have a big meeting space.
- The Southeast Watershed Forum does lots of training for communities.
- The South Mississippi Environmental and Agricultural Coordination Organization (SMEACO) is an excellent avenue to promote coordination and training on resilience.
- The Gulf Coast Ocean Observing System (GCOOS) just received authorization to hire an education coordinator. This position could help with outreach.
- In Southwest Florida, the Lee County Electrical Co-op, Florida Gulf Coast University, and Florida Department of Transportation have computer labs for technology training.
- The Mississippi Department of Marine Resources is an asset in bringing engineers, scientists, and developers together to share information.

COORDINATION NEEDS

The sheer number of issues and entities involved in coastal resource management and community resilience to coastal hazards suggests that effective coordination will always be a challenge. However, needs assessment participants did identify specific coordination needs they felt NOAA and a Gulf Coast Services Center might help to address. Some of these have been mentioned in earlier sections of the report, such as the need for coordination of restoration efforts and the need to bring together the diverse professions involved in assessing risk and planning for resilience. Additional coordination needs are described in this section, along with some ideas about how NOAA might foster coordination and collaboration in the region.

The Gulf of Mexico Alliance Has Great Potential

Needs assessment participants familiar with the Gulf of Mexico Alliance said the initiative has the potential to help with many regional needs, including enhanced regional coordination. The involvement in and support of the alliance by NOAA and the EPA as federal co-leads is seen as valuable, and participants urged NOAA to continue its involvement. Although the alliance is seen as a useful mechanism for coordination, many participants did voice concern about the alliance's ability to make progress without funding. Several participants said face-to-face alliance meetings have been very useful, and they hope these will continue. Several people also noted that one benefit they have already seen from the alliance is better communication among and within federal agencies.

The Pieces of NOAA and Other Federal Agencies Need to Work Together

As was discussed in the communication section of the report, customers and partners in the Gulf region find the array of NOAA programs and offices somewhat bewildering. In addition to a need for communication about the full suite of NOAA offerings, participants said there is also a basic need for better coordination among the different pieces of NOAA. People said there needs to be better and more communication across the different programs. For example, one resource manager said his agency receives requests for data on one issue from four different parts of NOAA. Those participants familiar with NOAA's new regional teams said this is a good sign, and said they would like to know more about this effort. To directly address this coordination issue, NOAA established eight regional collaboration teams composed of representative from all parts of NOAA. The Gulf collaboration team is working very closely with the Gulf of Mexico Alliance and other regional groups to ensure better communication of all NOAA programs.

Good Partners within NOAA

Within the overall need for better coordination across NOAA, participants identified specific programs that could be valuable partners in Gulf Coast Services Center efforts. Given the broad range of needs, it is clear that a host of NOAA programs will be important partners, but the following four were specifically mentioned during interviews and focus groups:

- **Office of Education:** This office can help reach into both primary and secondary classrooms, as well as help educate adults.
- **Sea Grant:** Sea Grant has good lines of communication with the fishing and seafood industry in Gulf states. The Sea Grant programs are a resource of information, and they can help get information out into communities.

- National Marine Fisheries Service: With multiple offices around the Gulf, NOAA Fisheries has valuable data, research, and contacts.
- National Weather Service: Participants suggested that the Weather Field Offices could be valuable partners for helping to push products and services out to users. In particular, emergency managers look to these offices to provide information and tools.

Coordination within and among Other Federal Agencies Is Needed

During the course of interviews and focus groups, there was considerable discussion about the need for more and better inter- and intra-agency coordination at the federal level. While there are organizational structures trying to address some of the interagency coordination needs (e.g., Gulf of Mexico Alliance Federal Working Group, Federal Geographic Data Committee, and the Interagency Working Group on Harmful Algal Blooms, Hypoxia, and Human Health), considerable coordination challenges remain. Participants identified areas where NOAA should work with other federal partners, as well as mentioned a number of coordination needs within other agencies.

Federal coordination needs often arose in the context of discussions about the complexity of taking an ecosystem-based approach to management or enhancing coastal community resilience. Diverse federal agencies and programs have different roles to play in both areas, and local and state partners and customers in the Gulf region were clear that federal coordination is essential to making progress. As recent experience with Gulf hurricanes demonstrates, this need for coordination is compounded after disasters, given the complex array of federal authorities and funding streams designed to provide response and recovery assistance.

Work with National Estuarine Research Reserves and National Estuary Programs

Many participants said there is a need for and value in enhanced coordination with both National Estuarine Research Reserves and National Estuary Programs. These entities are a great resource for place-based information and also have well-established relationships and partnerships with a host of stakeholders. Participants pointed out that there is much to learn from the National Estuary Programs' efforts to take a community-based and ecosystem-based management approach. Similarly, the reserves have extensive experience in place-based management, research, and education, and in fostering stewardship. As was mentioned in the communication section, reserves and estuary programs can help spread information and host events, and these entities are also interested in hosting research and trying out products.

Several participants from these programs also said they could benefit from greater coordination between reserves and estuary programs, and between sites in different parts of the Gulf. For example, an informal network of science coordinators from both reserves and estuary programs could share information and lessons learned from their respective research efforts. Having such a network would also provide a mechanism for sharing new research, tools, and products from NOAA.

Work with State Coastal Zone Management Programs

Similar to the reserves and estuary programs, there are mutual benefits to be realized by coordinating with the state Coastal Zone Management (CZM) programs. These programs are both customers and partners. Participants did note that the Gulf Center should be aware of the substantial differences in the Gulf states' CZM programs and help spread awareness of these differences among NOAA and other federal partners. Many of the needs identified by CZM programs have been identified in earlier sections of the report, but

one additional specific need was for help reviewing requests for proposals and subsequent submissions by potential grantees. CZM managers also suggested it would be valuable to have Gulf Center staff members attend their state meetings and get to know local players. Finally, CZM managers said that the federal consistency workshops previously offered by NOAA's Office of Ocean and Coastal Resource Management were useful and need to be sustained.

Coordinate with the Emergency Management Community

The assessment revealed that emergency managers are interested in continued coordination with the NOAA Coastal Services Center. Participants said the Coastal Services Center helps connect emergency managers with the "technological community," and there is a real need to maintain this connection. As with many audiences, there is also a need for more outreach to emergency managers about the range of NOAA products and tools.

Thinking about the coordination that is needed among the different entities involved in resilience to coastal hazards, participants suggested NOAA could play a valuable role in connecting emergency managers with coastal managers, floodplain managers, and planners. And some of this collaboration has already begun. For example, in the wake of hurricanes Katrina and Rita, Sea Grant has recognized a need to become more operationally connected to federal and state disaster operations systems. Likewise, emergency managers are becoming cognizant of the operational capabilities of Sea Grant.

Participants also said there is a need for greater coordination and collaboration between NOAA and the Federal Emergency Management Agency (FEMA). This coordination will be particularly important as efforts to understand and enhance community resilience to coastal hazards move forward. Participants suggested that NOAA and FEMA need to sort out their respective roles in different activities ranging from forecasting to mapping to response to long-term planning, finding a division of labor that makes sense given each entity's strengths.

Help Coordinate Coastal and Marine Mapping Players

As was discussed in the data and tools section, participants felt that NOAA could play a key role in coordinating data management and sharing. One area in particular where participants felt NOAA could help is in coordinating coastal and marine mapping efforts. There is a lot of remote sensing and mapping being done in the Gulf coast region, but there is little coordination across the many agencies involved. Fostering coordination could help expand the utility of these various mapping efforts, eliminate duplication of efforts, and identify opportunities to leverage resources for greater return.

Pursue Partnerships with Private and Non-Profit Entities

Along with the myriad coordination needs within the public sector, participants emphasized that coordination with nonprofit groups and private businesses is also needed. Both can be customers for information and tools, as well as important partners in projects. Conservation groups can also serve as conduits to private-sector funding. Several participants suggested there is a need to reach out directly to the private sector to encourage public-private collaborations. For example, the oil and gas industry could contribute to the development of improved circulation models. Likewise, the local chambers of commerce could be key partners in community resilience efforts.

As was discussed in earlier sections of the report, pursuing an ecosystem-based approach to management and enhancing community resilience will require coordinated efforts by many different players in the Gulf of Mexico region. Both nonprofit entities and private businesses will need to be at the table.

Next Steps: Using the Needs Assessment Results

As this report details, the needs assessment process has provided a wealth of information about specific needs related to resource issues and management activities. It has provided a snapshot of current activities and capacity in the region, and highlighted common constraints and needs that are faced by customers around the Gulf and across the public, private, nonprofit, and academic sectors.

The assessment results will be invaluable for informing and guiding the efforts of the new NOAA Gulf Coast Services Center. The findings are already shaping strategic planning efforts that are underway, and the many specific needs identified have the potential to provide project and product ideas well into the future. An additional value that cannot be encapsulated in a report is the host of strategic contacts that were made or renewed during the needs assessment process. The individuals who contributed their ideas will be valuable sources of information and partners for collaboration in the future.

The Gulf Coast Services Center's parent office, the NOAA Coastal Services Center in Charleston, South Carolina, will also look to the results of this needs assessment to help shape future activities. The Coastal Services Center is heavily engaged in the topics explored in the assessment; an ecosystem approach to management, coastal community resilience, data and technology tools, and communication and coordination are all areas where the Coastal Services Center strives to contribute. The positive feedback about existing products and services is heartening, and the needs identified suggest ways in which the Coastal Services Center can continue and expand this contribution in the Gulf of Mexico region. Similarly, both feedback on existing efforts and new needs point to ways in which the broader NOAA family can continue to bring value to the region. Assessment results are being shared with all the NOAA line offices and will inform the ongoing dialogue of the newly formed NOAA Gulf of Mexico Regional Collaboration Team and the four priority area task teams. All members of the NOAA Gulf of Mexico Regional Collaboration Team, which covers the five Gulf States, were provided with a copy of this needs assessment for review, comment, and consideration. The team used this document to help shape the selection of collaboration and communication activities in the first year.

Finally, the information gathered in the needs assessment has the potential to inform many diverse organizations involved with coastal resource management in the region. The report will be shared with everyone who participated in the focus groups and interviews, and be made available on the Coastal Services Center's website. The Gulf Coast Services Center will work to ensure that the issues raised in the assessment inform regional dialogue and projects, and will encourage partners to collaborate to address specific needs.

Appendix A: Cross-NOAA Steering Committee, Needs Assessment Team

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* Brent Ache of NOAA's Special Projects Office also conducted several interviews. This assistance was much appreciated.

Appendix B: Target Audiences

Primary Audiences

State and Federal Managers

- State Coastal Zone Management Programs (CZM)
- Other state agencies that deal with coastal issues (departments of natural resources, fish & wildlife, environmental protection, health, environmental quality)
- Florida Water Management Districts (WMDs) and Regional Planning Councils (RPCs)
- National Estuarine Research Reserves (NERRs) and National Marine Sanctuaries (NMSP)
- State Sea Grant programs
- National Estuary Programs (NEPs)
- Coastal National Wildlife Refuges and National Parks
- Gulf of Mexico Fisheries Management Council
- Gulf States Marine Fisheries Commission
- State floodplain managers
- State and local emergency managers
- County planners
- Associations of counties
- Coastal states' point of contact for National States Geographic Information Council (NSGIC)
- Coast Guard and state-level enforcement agencies
- U.S. Army Corps of Engineers districts
- Environmental Protection Agency Gulf of Mexico Program
- U.S. Forest Service
- State port authorities
- State departments of transportation

Nongovernmental Entities & Industries

- Regional Associations (RAs)
- University programs involved with coastal issues
- Nongovernmental organizations involved with coastal ecosystem and resilience issues (e.g., the Nature Conservancy, Shore and Beach Preservation Association, the American Red Cross, Place-based groups such as Apalachicola Baykeepers, and voluntary organizations)
- Coastal land trusts
- Media
- Oil and gas industry
- Fishing industry
- Ports and navigation industry
- Recreation and tourism
- Insurance industry

Secondary Audiences

The public
NOAA partners

Appendix C: 2006 Coastal Services Center Customer Survey Results for Respondents from Gulf States

Note: Percentages have been rounded to whole numbers, so totals may not add to 100.

A report on nationwide results from the 2006 survey, as well as results from past customer surveys, are available online at www.csc.noaa.gov/survey.

Overview of Gulf respondents

Of the over 400 total respondents to the 2006 survey, 79 were from the Gulf of Mexico states:

- 30 from Florida
- 20 from Alabama
- 14 from Texas
- 11 from Mississippi
- 4 from Louisiana

Respondents came from a variety of organizations:

- 6 respondents were from state Coastal Zone Management (CZM) programs
- 6 were emergency managers at either the local or state level
- 30 were from non-CZM agencies involved in coastal and marine resource management (e.g. Departments of Environmental Protection, Departments of Fish & Wildlife, Departments of Water Quality.)
- 10 were from National Estuarine Research Reserves
- 2 respondents were county planners

Respondents also reported holding a variety of positions within their organizations:

- 11% were in education and outreach
- 6% were in emergency management
- 10% were in information technology (GIS, remote sensing, or a related field)
- 19% were in natural resource management
- 6% were in permitting and regulatory enforcement
- 10% were in planning
- 23% were in program or site administration and management
- 9% were in research
- 5% were from a position type not listed on the survey

Most respondents have been in coastal resource management 10 years or less, although almost a quarter have been in the field over 15 years:

- 37% have been in the field 5 years or less
- 28% have been in the field 6-10 years
- 13% have been in the field 11-15 years
- 12% have been in the field 16-20 years
- 7% have been in the field 21-25 years
- 4% have been in the field over 25 years

Many respondents were familiar with the Coastal Services Center (CSC), and a significant percentage have used one or more CSC products and services:

- 57% are familiar or very familiar with CSC
- 60% have visited the CSC website
- 50% get one or more CSC publications
- 44% have attended a CSC workshop or training
- 30% have gotten technical assistance from CSC
- 37% have used data or other products from CSC
- 29% have partnered with CSC on a project

Priority Topics

Seven issues were identified as high priority by over 50% of Gulf respondents:

- Land use planning / growth management (61%)
- Hurricanes (61%)
- Flooding/inundation/storm surge (56%)
- Habitat restoration and monitoring (56%)
- Water quality monitoring (53%)
- Public access (52%)
- Watershed planning (51%)

Hazards Management Topics

Survey results revealed that many respondents feel they need to learn more about hazards management topics:

- 78% said “long term recovery” is a topic they need to know about for their job, and that they need to learn more about.
- 77% said “risk and vulnerability assessment” is a topic they need to know about for their job, and that they need to learn more about.
- 72% said “hazards mitigation” is a topic they need to know about for their job, and that they need to learn more about.
- 69% said “response immediately after a disaster” is a topic they need to know about for their job, and that they need to learn more about.
- 65% said “risk communication” is a topic they need to know about for their job, and that they need to learn more about.
- 51% said “forecasts and warnings” is a topic they need to know about for their job, and that they need to learn more about.

Asked to rank the relative priority of these hazards management topics, “risk and vulnerability” rose to the top, with 30% of Gulf respondents listing this as the number one priority. “Long term recovery” came in second with 19% ranking this as their top priority.

Spatial Data Use

(Note: 20% of Gulf respondents said they were not familiar with spatial data use in their office, so the following data are for the 80% of Gulf respondents that are familiar.)

- Current shoreline was the most commonly used data layer, with 77% reporting use of this layer in their office. an additional 20% said their office does not use this data layer, but that it would be useful.
- Coastal land cover was a close second, with 74% reporting that their offices use this layer. An additional 23% indicated their office does not use this data layer, but that it would be useful.

- Coastal land use came in third, with 70% reporting use of this layer in their office, and 25% saying it would be useful.
- Additional data layers being used by over 50% of respondents' offices:
 - Seagrass Distribution
 - Public Access
 - Elevation/topography
- Data layers that over 50% of respondents indicated were not currently being used but which would be useful:
 - Sediments
 - Suspended sediments
 - Coastal demographics
 - Marine and coastal economic data
 - Marine infrastructure
 - Dump/discharge sites (NPDES)
 - Aquaculture sites
 - Salinity
 - Sea surface temperature
 - Primary productivity
 - Fish habitat distribution maps
 - Shellfish bed distribution
 - Cultural and historical resources
 - Sensitive habitats
 - Waves
 - Currents
 - Tides
 - Shoreline change/erosion
 - Critical facilities

Technology Tools to Support Coastal Resource Management

Survey data provided insight on Gulf respondents' use of various technology tools, as well as the most common constraints to use. Tool use is described below, listed from most-used to least-used:

- Geographic Information Systems (GIS): 91% reported that they or their offices use GIS. 90% said this tool has high utility. For those who reported constraints to using this tool, lack of required knowledge / skills was the biggest constraint (35%). Other top constraints were conflicting demands on time and insufficient staff.
- On-line databases (data portals, data clearing houses): 77% reported that they or their offices use on-line databases. 34% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time was the biggest constraint (38%). Other top constraints were lack of required data, lack of required knowledge/skills, and insufficient staff.
- On-line Mapping: 75% reported that they or their offices use on-line mapping for browsing or viewing data. 40% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time was the biggest constraint (40%). Other top constraints were lack of required data, lack of required knowledge/skills, and insufficient staff.
- Visualization (GIS-, 3D-, and photo-based): 64% reported that they or their offices use visualization. 44% said this tool has high utility. For those who reported constraints, lack of required knowledge/skills was the biggest constraint (37%). Other top constraints were inadequate equipment/facilities/technology, lack of required data, conflicting demands on time, and insufficient staff.

- Remote sensing tools: 60% reported that they or their offices use remote sensing tools. 73% said these tools have high utility. For those who reported constraints, lack of required knowledge/skills was the biggest constraint (42%). Other top constraints were conflicting demands on time and insufficient staff.
- Coastal and ocean observations: 57% reported that they or their offices use coastal and ocean observations. 25% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time was the biggest constraint (25%).
- Decision-support tools (manipulating / analyzing data): 56% reported that they or their offices use decision-support tools. 46% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time was the biggest constraint (37%). Other top constraints were lack of required knowledge/skills, and insufficient staff.
- Models or model outputs (habitat modeling, SLOSH, HURREVAC): 43% reported that they or their offices use models or model outputs. 32% said these tools have high utility. For those who reported constraints, lack of required knowledge/skills was the biggest constraint (46%). Other top constraints were lack of required data, conflicting demands on time, and insufficient staff.

Utility of different types of assistance with technology tools and data:

The survey asked respondents about whether several different types of assistance would have high, medium, low, or no utility. The following list shows the percentage indicating each type of assistance would have high utility, listed from highest to lowest:

- Providing data: 73%
- Providing training on existing software: 71%
- Providing on-site technical assistance in use of software: 59%
- Developing customized applications: 53%
- Evaluating existing software for coastal applications: 49%
- Developing case studies detailing the uses of existing software: 40%
- Inventorying available software: 34%

Human dimensions tools

The survey asked about human dimensions tools (e.g. social science methods, strategic planning tools) and constraints to using these tools. Tool use and constraints are described below, listed from most-used to least-used:

- Meeting facilitation: 64% reported that they or their offices use meeting facilitation. 33% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time and insufficient staff were the biggest constraints (19% each).
- Strategic Planning: 62% reported that they or their offices use strategic planning. 30% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time was the biggest constraint (25%).
- Stakeholder engagement processes: 61% reported that they or their offices use stakeholder engagement processes. 41% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time (26%) and insufficient staff (21%) were the biggest constraints.
- Surveys: 61% reported that they or their offices use surveys. 19% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time and insufficient staff were the biggest constraints (19% each).
- Performance measures or indicators: 60% reported that they or their offices use performance measures or indicators. 58% said this tool has high utility. For those who reported constraints to using this tool, insufficient staff was the biggest constraint (24%).

- Project management: 52% reported that they or their offices use project management. 37% said this tool has high utility. For those who reported constraints to using this tool, lack of required knowledge/skills was the biggest constraint (23%).
- Evaluation of individual products or projects: 47% reported that they or their offices use evaluation of individual products or projects. 24% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time and insufficient staff were the biggest constraint (18% each).
- Needs Assessments: 46% reported that they or their offices use needs assessments. 24% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time was the biggest constraint (28%). Other top constraints were insufficient staff and lack of required knowledge/skills.
- Interviews: 45% reported that they or their offices use interviews. 13% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time was the biggest constraints (17%).
- Observation: 44% reported that they or their offices use observation. 27% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time was the biggest constraints (19%).
- Evaluation of entire programs: 43% reported that they or their offices use evaluation of entire programs. 18% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time was the biggest constraint (17%).
- Focus groups: 42% reported that they or their offices use focus groups. 11% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time was the biggest constraints (19%).
- Policy/legislative analysis: 38% reported that they or their offices use strategic planning. 25% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time was the biggest constraint (19%).
- Cost-benefit analysis: 35% reported that they or their offices use cost-benefit analysis. 12% said this tool has high utility. For those who reported constraints to using this tool, insufficient staff was the biggest constraints (19%).
- Demographic analysis: 33% reported that they or their offices use demographic analysis. 15% said this tool has high utility. For those who reported constraints to using this tool, insufficient staff was the biggest constraints (19%).
- Stakeholder analysis: 33% reported that they or their offices use stakeholder analysis. 25% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time was the biggest constraints (29%).
- Logic models: 25% reported that they or their offices use logic models. Only 3% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time was the biggest constraint (18%).
- Social assessments: 21% reported that they or their offices use social assessments. 8% said this tool has high utility. For those who reported constraints to using this tool, lack of required knowledge/skills was the biggest constraint (19%).
- Content analysis: 17% reported that they or their offices use content analysis. 10% said this tool has high utility. For those who reported constraints to using this tool, conflicting demands on time was the biggest constraints (17%).
- Non-market valuation: 9% reported that they or their offices use non-market valuation. 7% said this tool has high utility. For those who reported constraints to using this tool, insufficient staff and lack of knowledge/skills were the biggest constraints (12% each).

Methods Used to Get or Exchange Information

The following list shows the percentage of Gulf respondents using different methods to exchange information about tools, technology, or other issues related to their jobs:

- Talking with colleagues (100%)
- Professional meetings and conferences (93%)
- Workshops (91%)
- Trainings (85%)
- Websites (81%)
- Technical documents, government reports, conference proceedings (73%)
- Scientific journals (67%)
- Newsletters (63%)
- E-mail discussion groups (list serves) (53%)
- CDs (53%)
- Private sector relationships (51%)
- Books (51%)
- Trade publications or corporate reports (41%)
- Magazines (45%)
- Electronic journals (e-journals) and electronic magazines (e-zines) (40%)
- Web-based discussion groups (27%)

Training: Constraints to participating and applying, Interest in online learning

- 61% said conflicting demands on time always or often limits their ability to attend trainings.
- 40% said awareness of trainings always or often is a constraint, while 38% said availability of training is always or often a constraint.
- 35% said lack of funding always or often limits their ability to attend trainings.
- 21% said travel restrictions always or often limit their ability to attend trainings.
- Only 9% said lack of management support always or often limits their ability to attend trainings.
- When asked what barriers or constraints have limited their ability to *apply* knowledge or skills acquired during trainings, the most frequent responses were related to time constraints and conflicting demands on time.
- 49% have participated in on-line distance learning, and 30% said they have a high level of interest in on-line distance learning.

Appendix D: Focus Group Locations and Participants

Focus group locations:

| | | |
|--|--------------------|----------------------------|
| Gulf Coast Ocean Observing System Board of Directors Meeting | August 24, 2006 | St. Petersburg, Florida |
| National Emergency Management Association Annual Conference | September 21, 2006 | Orange Beach, Alabama |
| State Coastal Zone Management Programs: Southeast Regional Meeting | November 14, 2006 | Charleston, South Carolina |
| Restore America's Estuaries 3 rd National Conference on Coastal and Estuarine Habitat Restoration | December 14, 2006 | New Orleans, Louisiana |

Participants:

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|------------------|--|
| Suzanne Adams | Florida Dept. of Community Affairs, Division of Emergency Management |
| Kacky Andrews | Coastal States Organization |
| Brandon Bolinski | Federal Emergency Management Agency Region 4 |
| Becky Boudreaux | University of New Orleans |
| Cortis Cooper | Chevron Texaco |
| John Dosh | Escambia County (Florida) Emergency Management |
| Gregory DuCote | Louisiana Dept. of Natural Resources, Coastal Management |
| Eddie Fisher | Texas General Lands Office |
| Lynn Griffin | Florida Coastal Management Program, Florida DEP |
| Phillip Hinesley | Alabama Department of Conservation & Natural Resources |
| Carrie Hall | NOAA Office of Ocean and Coastal Resource Management |
| Brad Hattaway | Escambia County (Florida) Emergency Management |
| Janis Helton | Alabama Dept. of Conservation & Natural Resources |
| Willa Henrikson | Mississippi Department of Marine Resources |
| Sharon Hodge | Northern Gulf Cooperative Institute |
| Matt Howard | Texas A&M University |
| Ann Jochens | Texas A&M University |
| Jane Kushma | Jacksonville State University |
| Ali Legett | Mississippi Department of Marine Resources |

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|----------------------|--|
| Ed Levine | NOAA Office of Response & Restoration, Marine Debris Program |
| Brock Lon | Federal Emergency Management Agency Region 4 |
| Josh Lott | NOAA Office of Ocean and Coastal Resource Management |
| Mark Luther | University of South Florida |
| Robert (Buzz) Martin | Texas General Land Office |
| Bill Massey | Dewberry |
| Frank McCrory | Alabama Emergency Management Agency |
| Matt Miller | Federal Emergency Management Agency, Mitigation |
| Liz Mountz | NOAA Office of Ocean and Coastal Resource Management |
| Katie Niemi | U.S. Fish & Wildlife Service |
| Worth Nowlin | Texas a&M University |
| Chris Oynes | Minerals Management Service |
| Linda Pace | Louisiana Dept. of Natural Resources, Coastal Management |
| Neal Perry | NOAA Office of Response & Restoration, Marine Debris Program |
| Alfredo Prelat | PAR Government Systems Corporation |
| Nancy Rabalais | Louisiana Universities Marine Consortium |
| Ben Rhame | Texas General Lands Office |
| Laurie Rounds | NOAA Office of Ocean and Coastal Resource Management |
| Raymond Toll | Science Applications International Corporation |
| Carleigh Trappe | NOAA Office of Ocean and Coastal Resource Management |
| Lesley Turney | Alabama Dept. of Conservation & Natural Resources |
| Tina Sanchez | South Alabama Regional Planning Council |
| Mike Spranger | Florida Sea Grant Program |
| Vembu Subramanian | University of South Florida |
| Sharon Walker | University of Southern Mississippi |
| Julie Shiyou-Woodard | South Alabama Regional Planning Council |

Appendix E: Individuals Interviewed

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|---------------------|---|
| Mark Alderson | Sarasota Bay Estuary Program |
| Tim Alexander | Northern Gulf Institute, Mississippi State University |
| Diane Altsman | Environmental Protection Agency, Gulf of Mexico Program |
| Kacky Andrews | Coastal States Organization |
| Steve Atran | Gulf of Mexico Fishery Management Council |
| Stephanie Bailenson | Florida Department of Environmental Protection, Coastal and Aquatic Managed Areas |
| Patrick Banks | Louisiana Department of Wildlife and Fisheries |
| Russell Beard | NOAA National Coastal Data Development Center |
| Lisa Beever | Charlotte Harbor National Estuary Program |
| Harry Blanchet | Louisiana Department of Wildlife and Fisheries |
| Seth Blicht | Apalachicola National Estuarine Research Reserve |
| Michael Bograd | Mississippi. Department of Environmental Quality |
| Marty Bourgeois | Louisiana Department of Wildlife and Fisheries |
| Jennifer Buchanan | Grand Bay National Estuarine Research Reserve |
| Rafael Calderon | The Nature Conservancy |
| Glorida Carr | Environmental Protection Agency, Gulf of Mexico Program |
| John Cortinas | NOAA Office of Laboratories and Cooperative Institutes |
| Eric Crassughet | Northern Gulf Institute, Florida State University |
| Richard Crout | NOAA National Data Buoy Center |
| Marian Dicas | Grand Bay National Estuarine Research Reserve |
| John Dindo | Dauphin Island Sea Lab |
| Quenton Dokken | Gulf of Mexico Foundation |
| David Driver | BP America, Inc. |
| Helen Drummond | Galveston Bay Estuary Program |
| Richard Eckenrod | Tampa Bay Estuary Program |
| Marcia Garcia | Mississippi Department of Marine Resources |
| Holly Greening | Tampa Bay Estuary Program |
| Ken Heck | Northern Gulf Institute, Dauphin Island Sea Lab |
| Dan Henderson | NOAA National Data Buoy Center |

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|--------------------|---|
| Sharon Hodge | Northern Gulf Institute, Mississippi State University |
| Riley Hoggard | National Park Service, Gulf Island National Seashore |
| Rob Hudson | Photo Science |
| Steven O. Jenkins | Alabama Department of Environmental Management |
| Rosalyn Kilcollins | Apalachicola National Estuarine Research Reserve |
| Grant Larsen | Mississippi Department of Marine Resources |
| D. Herb Leedy | Minerals Management Service, Environmental Science Section |
| Steven Lohrenz | Northern Gulf Institute, University of Southern Mississippi |
| Steve Lyle | Mississippi Department of Transportation |
| Chris May | Grand Bay National Estuarine Research Reserve |
| Larry McKinney | Texas Parks and Wildlife |
| Sally Morehead | Mission Aransas National Estuarine Research Reserve |
| Bruce Moulton | Texas Commission on Environmental Quality |
| Henry Norris | Florida Fish & Wildlife Conservation Commission |
| Debbie Norton | Santa Rosa Island Authority |
| Christine Olsenius | Southeast Watershed Forum |
| Rost Parsons | NOAA National Coastal Data Development Center |
| Harlon Pearce | Commercial Fisherman, Louisiana |
| Melody Ray-Culp | United States Fish & Wildlife Service, Coastal Program Region 4 |
| Susan Rees | United States Army Corps of Engineers, Mobile District |
| Jeff Rester | Gulf State Marine Fisheries Commission |
| Scott Robinson | Southeast Aquatic Resources Partnership |
| David Ruple | Grand Bay National Estuarine Research Reserve |
| Margaret Sedlecky | Weeks Bay National Estuarine Research Reserve |
| David Shaw | Northern Gulf Institute, Mississippi State University |
| Tina Shumate | Mississippi Department of Marine Resources |
| David Still | Suwannee River Water Management District, Florida |
| Tabitha Stadler | Rookery Bay National Estuarine Research Reserve |
| Robert R. Stickney | Texas Sea Grant |
| Kerry St. Pe | Barataria-Terrebonne National Estuary Program |
| Kristen Strellec | Minerals Management Service |
| LaDon Swann | Mississippi-Alabama Sea Grant |
| Dr. Robert Twilley | Northern Gulf Institute, Louisiana State University |

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| Michael Uhart | NOAA Office of Laboratories and Cooperative Institutes |
| William Walker | Mississippi Department of Marine Resources |
| Christine Walters | Grand Bay National Estuarine Research Reserve |
| Heather Warner-Finley | Louisiana Department of Wildlife and Fisheries |
| Steven H. Wolfe | Florida Department of Environmental Protection |
| Glade Woods | Northern Gulf Institute, Mississippi State University |
| Lee Yokel | Environmental Education Network, Gulf of Mexico Alliance |
| Leslie Young | Mississippi Department of Marine Resources |
| Lisa Young | Dauphin Island Sea Lab |
| Clayton Younts | Grand Bay National Estuarine Research Reserve |
| Jan van Smirren | FugroGEOS |

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