
SUMMARY

HOW DO COASTAL MANAGERS—the diverse community of organizations and individuals who make or are otherwise involved in decisions that affect coastal lands, waters, and natural resources—learn about and apply innovative and successful processes, practices, and tools for coastal problem solving? And how can the governmental and nongovernmental organizations that support them be more responsive in providing that information in useful forms and assisting in its adaptation to local situations and needs? Examining these questions was the principal purpose of this study and is the subject of this report.

The impetus for the study came from the U.S. Office of Ocean and Coastal Resource Management (OCRM), the National Oceanic and Atmospheric Administration (NOAA) office responsible for administration of the Coastal Zone Management Act (CZMA). OCRM provides national leadership for thirty-five coastal states and territories eligible to participate in the national coastal zone management program—thirty-four of those states have federally approved programs covering more than 99 percent of U.S. coastlines. OCRM provides policy guidance, grants, and technical assistance to states, and evaluates their performance. With the primary goal of increasing their capacity for providing needed technical assistance, in 2002 OCRM asked The Heinz Center to undertake a study of how innovative ideas and practices are shared within the coastal management community, and to recommend improvements that would foster more effective and efficient information transfer. Recognizing that there are many other organizations and programs involved in coastal management, OCRM asked The Heinz Center to look broadly at technical assistance to coastal managers, not only at the programs that they administer. The audience for the study thus includes local, state, and federal agency decision makers and professionals charged with implementation of the variety of laws and

programs designed to address the whole range of coastal conservation and development issues, as well as coastal managers in the private sector involved in these processes.

The day-to-day work of coastal managers is primarily focused on carrying out policies designed to achieve programmatic goals—protecting sensitive habitats and species, reducing the vulnerability of people and property to natural hazards, providing for the recreational needs of diverse visitor populations, and promoting appropriate and sustainable development. To do this well, coastal managers need ready and efficient access to relevant data, information, tools, and processes best suited to each task. Often this entails learning from others who have had to deal with similar issues, and adapting that experience to their own situation. Yet, as OCRM's experience and survey data from the NOAA Coastal Services Center suggest, coastal managers find the process of learning from others cumbersome, hit-or-miss, and too consumptive of time, energy, and resources. How might the learning and technical assistance process be improved? To answer this and related questions, The Heinz Center organized a Committee on Sharing Coastal Zone Management Innovations, drawing on the expertise of representatives from government, academia, industry, and environmental organizations.

Chapter 1 of this report provides background on the problem and details the committee's approach and methods. The committee identified three objectives: (1) to define the problem more clearly by documenting how we presently share coastal problem-solving ideas and practices in government, academic, business, and not-for-profit sectors; (2) to evaluate the strengths, limitations, and outlook for present information-sharing methods and efforts; and (3) to identify ways to improve information sharing and learning, drawing on the experiences of those within and outside the coastal management community. The committee collected data through structured interviews with coastal managers; a coastal manager workshop, designed to explore in more depth questions raised in the survey; and a review of the literature and the experiences of similar communities of practice. The committee also identified examples of innovative practices and information-sharing techniques that were being used within the coastal management community.

Chapter 2 provides an overview and examples of how coastal managers—broadly defined here to include governmental, nongovernmental, and private sector decision makers and professionals—access the data, information, and tools they need. It is very much a demand-driven,

decentralized process, with constraints and limitations imposed by available knowledge, skills, data accessibility, resources, and training.

Chapter 3 examines the important roles that networks play in information sharing and learning in coastal management. This focus is in part based on the clear message the committee received from its survey and workshop participants that networking was central to their learning about new ways to solve problems. The committee examined various types of networks for their potential to serve the information-sharing and learning needs of coastal managers.

Chapter 4 examines the rapid advances in communication, information, and sensor technologies and how they have transformed the ways in which coastal managers learn about and share innovations. Although these new technologies are enormously powerful or promising, they require significant investments of time, financial resources, staff, and energy. Capacity and access to technology varies. It is difficult to determine which technologies will be good investments at any point and what kinds of organization, training, and human connections will be needed to put them into practice. The challenge, then, is to make technology serve coastal managers and decision makers, not the other way around.

The findings summarized below reveal how coastal managers are gathering and evaluating information today, how networks are fostering innovation and information sharing, and how technology is contributing to the process. Specific recommendations then follow about how to foster innovation and improve information sharing in coastal management.

HOW COASTAL MANAGERS LEARN TODAY

Coastal management today has its roots in an array of environmental policies initiated more than thirty years ago—the Coastal Zone Management Act and the Clean Water Act are prime examples—as well as the rise of citizen activism during the same era and the private sector response to these new policies. Coastal policies, the citizen activism that sustain them, and business response have evolved over the years. Emphases today are on sustainability, ecosystem-based and precautionary approaches, integrated management, and transparent decision making, among other themes. Other factors bearing on the evolution of coastal management are rapid advances in information technologies and technical tools, improved scientific understanding of complex coastal and ocean problems, increased

sophistication of planning and coordination processes, and more focused outreach and technical assistance programs.

When coastal managers need to learn about innovative practices and problem solving elsewhere, they cast a broad net. New and evolving technologies like the Internet, the World Wide Web, and powerful search engines play an increasingly important role in this process. Nonetheless, tapping into personal and organizational networks is even more important. Coastal managers are busy people, so the information search process is largely demand driven. They seek out those they know and trust first—people and organizations that are part of their personal networks. Often, client coastal managers (e.g., state coastal program managers) seek information about innovative approaches from their program sponsors (e.g., OCRM). This is logical because the managers must go to these sources for policy guidance, funding, and other program implementation activities. Nevertheless, this “stovepipe” model may be inhibiting the flow of innovative ideas and information among programs with similar goals, and may even set up competitive situations where organizations attach themselves to or become identified with particular innovations, much the same as private sector companies protect their proprietary interests in ideas. Coastal managers also seek information from other coastal management programs or from organizations whose primary mission is to provide data, information, technical assistance, and outreach services—examples include university-based Sea Grant extension programs, the NOAA Coastal Services Center, and more recently, the coastal training network of the National Estuarine Research Reserves.

What drives the diffusion and adaptation of good ideas in coastal management? New public policy initiatives are often drivers for both innovation and diffusion. An example is the National Estuary Program, established through 1987 amendments to the Clean Water Act, which helped catalyze the “watershed approach” to estuarine and aquatic resource management. Another example is NOAA’s Coastal Zone Enhancement Grants Program, part of 1990 amendments to the CZMA. That program provided support to states to experiment with new approaches to address chronic coastal problems such as cumulative impacts of development, increased demand for public access, and habitat protection. The result was a new generation of more sophisticated, problem-focused coastal management programs.

Another important factor in the diffusion of coastal management innovations has been the role of “champions”—individuals whose long-

term commitment to developing, describing, publicizing, marketing, and providing technical assistance for innovative coastal management practices has made a difference. Conferences such as those of the Coastal Society and the biennial Coastal Zone meetings build and sustain the formal and informal networks and personal relationships that are so important for information sharing, not just during the events, but for years afterward. More focused workshops are important as well for in-depth, specialized learning. The continued seeding of the coastal management profession with recent graduates of specialized marine science and policy graduate programs is another important factor in the diffusion of new ideas—often learned in a more theoretical context, but then put to the test in the field.

Looking ahead, coastal managers envision significant changes in how they learn about and apply new ideas to solve increasingly complex problems, especially in the role that technology might play in the field. They also see the need to maintain and strengthen traditional mechanisms for information transfer—conferences and targeted workshops will continue to be important—but more and better use of new networking technologies, such as video conferencing and Internet streaming, will also be necessary. Coastal managers would like to see a reliable, quick-response “consulting service” available as well, providing technical assistance to adapt and tailor ideas to particular situations. Information purveyor networks—Sea Grant, the Coastal Services Center, the National Estuarine Research Reserves—will remain vital, but will need to be better integrated and coordinated across agencies, organizations, and levels to be most effective. Coastal managers also noted barriers and constraints to optimizing the development and diffusion of innovations in coastal management practice. Major problems that need to be addressed include information overload, the “stovepipe” information flow problem noted earlier, limited resources for travel to conferences and workshops, the risks of experimentation, and the bias against reporting failures (and consequent loss of learning opportunities).

Two closely linked themes pervaded the committee’s interactions with coastal managers. One was the importance of people-centered networks in fostering innovation and spreading information. The other was the growing role of technology. As we consider how to develop more conscious, robust learning networks in coastal management, these two themes—one focused on human interactions and the other on computer-based connections—must be viewed as fully interdependent. Neither alone is sufficient.

LEARNING NETWORKS AND COASTAL MANAGEMENT

Networks are ubiquitous in all collective human endeavors. In coastal management, there are hundreds, perhaps thousands, of networks, often self-organizing and sustaining. Some networks are organized around issues such as natural hazard mitigation or habitat restoration, and are inherently multidisciplinary. Other networks are based on professional identities and training; thus we have disciplinary organizations for planners, engineers, or wetland ecologists. Sectoral networks, based on broad institutional connections, are another type—fishing industry organizations or government agencies concerned with pollution control are examples. Political networks of all varieties operate in coastal management as well, attempting to affect public policy and promote agendas. Political networks overlap considerably with other kinds of networks. Issue networks, for example, are usually strongly linked to particular problems and policy solutions.

Virtually all of these networks have learning as one of their principal functions—thus the term *learning networks*. Some organizations are formed consciously to function as a learning network, developing, testing, and transferring innovations and information—the ten-year-old NOAA Coastal Services Center is such an organization serving coastal managers.

We can distinguish learning networks by their structure, purpose, membership, formality, governance, and other features. Some are quite formal and structured, such as a state coastal management program or a project team within such a program. Professional networks (e.g., the Coastal Society), sectoral networks (e.g., the American Association of Port Authorities), and issue networks (e.g., Sea Grant's hazards network or HAZNET) each have different degrees of formality and structure. Collaborative networks (e.g., the Ocean Governance Study Group) and communities of practice (e.g., the Locally Managed Marine Area Network) may be formal or informal, but are generally characterized by their membership, which is often by invitation only.

A key feature of these and other coastal management learning networks is their ownership by members. Ownership implies participation and involvement in decisions about how the network can be most useful for learning. This does not mean that all networks need to be highly structured and organized. Quite the opposite—networks need to serve their members and thus may take many forms.

Learning networks can be differentiated by a number of other important features: their organizational culture and leadership; the resources they have at their disposal; the roles of members, particularly who will act as the “node” of the network; and network connections, internally and externally. With respect to culture and leadership, a key issue is the degree to which an organization and its leaders choose to be innovative—that is, to empower its members to experiment and take risks, to share ideas and practices, and to learn from others. Being innovative and sharing ideas, of course, is always easier when resources are abundant (which they almost never are). Effectively connecting multiple learning networks to add value to all is another challenge.

Recognizing and transferring useful innovations and information to others, and learning about, acquiring, and adapting or tailoring the innovations of others, are key functions of an effective learning network. But they are not necessarily simple functions. They often require the time and energy of a network’s most experienced, savvy members. Learning network members need to be able to understand the importance of context to the successful adaptation of an innovation. They need to be aware of the substitutability of institutions (or not) from one location to another, the resources needed to transfer an innovation, and the relative complexity of both the innovation and the transfer process.

Most coastal management networks probably function fairly well with respect to innovation—learning, adapting, and sharing ideas and information. Few, however, have been seriously evaluated as true learning networks, as defined here. Most coastal management organizations address innovation issues intuitively, in an ad hoc, haphazard manner. Although this approach seems to work at some level, it is intriguing to imagine what a more conscious, deliberate effort to build effective learning networks within the coastal management community might accomplish. The continuing rapid development of information technologies makes such an undertaking feasible. The huge pressures on coastal areas and resources, the resulting problems, and the need for more sustainable development make it necessary.

TECHNOLOGICAL CHANGE AND COASTAL MANAGEMENT

The practice of coastal management is being transformed by remarkable technological developments in advanced communications, information

management, and remote sensing. The Internet, the World Wide Web, geographic information systems (GIS), real-time observing systems, and other technologies enhance learning and create new methods for learning. The result is a flood of numbers and types of learning networks available to coastal managers and a deluge of information—some relevant and useful to coastal problem solving, much of it not. Some coastal managers and organizations are open to the new technologies, while others have tried to channel or filter the flow, creating personal and virtual firewalls. The challenge for coastal managers is to incorporate these new technologies into their existing learning networks in ways that enhance, rather than degrade, the learning and information-sharing process. This will require much more attention to the interfaces among people, organizations, and new technologies. Although the direction of technological change is unpredictable, the advent of wireless communications, artificial intelligence, software tools such as bots, and ever-increasing computing power will continue to transform the practice of coastal management. Suitable governance arrangements for incorporating new technology into coastal management, and for collecting, documenting, processing, and applying data and information will be needed.

RECOMMENDATIONS

Coastal managers will continue to learn in many ways—from face-to-face meetings, conferences, workshops, Internet searches of the World Wide Web, and many other sources—and they will also continue to innovate and share what they learn. Nevertheless, the community has many opportunities to improve the learning potential of its myriad networks, opportunities that are expanding daily as technology changes. Barriers and constraints must be removed to take fuller advantage of these opportunities. Incentives to generate and accurately document innovative practices are a clear need, as are standards, so that best practices can be validated as widely applicable and repeatable. More concerted attention to diffusion of innovations is also needed, with provisions for documenting and collecting experience, facilitating the searching process, and adapting and tailoring information to local contexts. The five recommendations presented here address these and other issues identified by the committee (Box S.1).

Box S.1 Recommendations of the Committee on Sharing Coastal Zone Management Innovations

- The committee recommends that organizational leaders evaluate and strengthen coastal management learning networks.
- The committee recommends that NOAA develop and manage a compendium of examples and studies of the best coastal and ocean management practices, supported by a network of experts.
- The committee recommends the expansion of cross-training of personnel to broaden mutual understanding of coastal management problems, practices, and uses of technology.
- The committee recommends that coastal management organizations and agencies increase the use of communication technology for real-time, distributed learning.
- The committee recommends that organizations institutionalize a learning process about interactions between technology and coastal management.

■ The committee recommends that organizational leaders evaluate and strengthen coastal management learning networks.

The exchange of ideas and information within and among learning networks in coastal management plays a vital role in stimulating innovation and facilitates the transfer of ideas to others who adapt and tailor them to fit their needs. Given daily demands and limited resources, however, little explicit attention is given to nurturing these networks to realize their potential. For innovation and network-based learning to be fixtures in coastal management practice, the individuals that lead organizations need to encourage experimentation, risk taking, and similar behaviors not generally found in the field. This is especially true in the public sector, where political forces sometimes push in the opposite direction. The findings of this report suggest a number of needed actions to improve and strengthen learning networks in coastal management.

- *Increase Support to Learning Networks.* NOAA, as the nation's public sector leader for ocean and coastal affairs, should create an environment within and outside government that supports a wide range of existing and new learning networks designed to encourage and share innovative and best practices for coastal management. Because of the nature of learning networks—informal ones often being more nimble than formal—care should be taken not to provide too much structure. Organizations such as the Office

of Ocean and Coastal Resources Management and Coastal Services Center have or can develop the research capacity, multiple linkages, and technical facility to become stronger nodes and facilitators of learning network nodes. Other organizations within and outside government that have established effective learning networks—Sea Grant, the U.S. Environmental Protection Agency (USEPA), and Restore America’s Estuaries, for example—should participate in this process as full partners, recognizing their unique potential contributions. All such learning networks should be encouraged to examine their capacity and effectiveness in fostering innovation and learning.

- *Leadership Training for Innovation.* The NOAA Coastal Services Center, in collaboration with OCRM, the USEPA, Sea Grant, and academic programs in marine affairs and policy, should develop and deliver a training program for coastal management leaders that emphasizes the potential of learning networks to promote knowledge-based problem solving. Training about learning networks and their roles in innovation, adaptation, and change needs to be fostered at all levels, including formal education. In particular, graduate students being trained for coastal management should be steeped in learning networks and innovation processes.
- *Collaboration among Information Purveyors.* Organizations for which outreach is a principal function* should work more closely to increase their effectiveness with coastal manager audiences, and reduce duplication and competition. Partnership building methods for Coastal Training Programs at National Estuarine Research Reserves serves as a good model.
- *Multinodal Learning Network.* NOAA should establish a multinodal learning network for identifying, documenting, validating, collecting, searching for, and tailoring best coastal management practices to local contexts. The challenges are to identify practitioner information needs, preferred communication media, and incentives to encourage practitioners to treat the network node as an accepted information broker and network facilitator.

* Sea Grant Extension, the Coastal Services Center, and the Coastal Training Program are examples highlighted in Box 2.4, pages 39–42.

■ **The committee recommends that NOAA develop and manage a compendium of examples and studies of the best coastal and ocean management practices, supported by a network of experts.**

The committee proposes that NOAA establish a compendium of peer-reviewed case studies and examples of innovative or successful coastal management practices—best coastal and ocean management practices, or BCOMPs. The committee acknowledges that this idea is not new and that it raises concerns about the maintenance, management, and utility of such a repository. Case studies become quickly outdated, quality is mixed, adaptation and tailoring is difficult, and best practices may be misapplied. There are ways to overcome some of these shortcomings:

- Establish the system as a Web-based, searchable portal (similar to and perhaps in conjunction with GIS data nodes being established).
- Institutionalize incentives, mechanisms, and standards for submitting BCOMPs.
- Provide sufficient structure to make the system self-organizing, logical, and demand-driven.
- Link the compendium to an expert network that can assist coastal managers in the adaptation and tailoring of BCOMPs to unique local contexts.

Many existing coastal management networks would have roles to play in such a system. OCRM and its client state coastal programs could identify candidate BCOMPs through coastal zone management performance and other evaluation processes. The NOAA Coastal Services Center could serve as a national node or coordinator for such a system. Many of its own technology-based projects currently available on the World Wide Web are candidate BCOMPs, and Coastal Services Center staffers could help identify others. Sea Grant's university-based programs in every coastal state could also serve as nodes in such a system. Other coastal management agencies and programs—including the USEPA, the U.S. Fish and Wildlife Service, NOAA Fisheries, the National Park Service, Coastal America, state agencies, nongovernmental organizations, and private-sector businesses and trade organizations—might also identify, nominate, or prepare BCOMPs, using specified criteria and formats, and serve as additional nodes.

A Web-based, online compendium is one possible approach, operated by a consortium of university-based marine affairs and policy graduate programs, faculty, students, and others providing well-researched, documented cases meeting high standards of relevancy and quality. Incentives for submissions might include awards for “most innovative practice” or other recognition. Examples from international coastal management could be included through regional nodes. Specialists, available as consultants to assist in assessing applicability and tailoring lessons, could be a feature of such a system. Use of artificial intelligence agents (bots) to guide the searcher to appropriate information or case examples in the compendium could be explored. Organization of such a system of BCOMPs will be a challenge—a traditional structure (shown in Table S.1) is one alternative, but a more open system based on key words or phrases might be another.

Finally, standard formats for presenting case examples and studies will be needed to capture, at the very least, the what, who, why, and how, along with outcomes and lessons learned. This last category also opens up the door for examples of what did not work and what adaptive learning took place in the process.

▪ **The committee recommends the expansion of cross-training of personnel to broaden mutual understanding of coastal management problems, practices, and uses of technology.**

Training across sectoral, professional, political, governmental, hierarchical, and other boundaries helps coastal management professionals learn, understand other perspectives, and appreciate the constraints and limitations encountered by their colleagues in different organizations. The diversity within the field of coastal management makes this cross-training even more necessary.

The committee recommends that NOAA, the USEPA, and other federal coastal agencies, in collaboration with the Coastal States Organization and nongovernmental organizations, expand the use of the federal Intergovernmental Personnel Act (IPA) in the field of coastal management to include professionals from state and local governments, nongovernmental organizations, academia, industry, and others who might be eligible. A guide to IPA opportunities in coastal management should be developed by NOAA and a program established to coordinate short-term assignments. Transfers should be two-way, ideally switching specific jobs.

Table S.1 Preliminary Organization for a Compendium of Best Coastal and Ocean Management Practices

Category	Examples
Applied research and technology	Defining management-related research needs, e.g., National Estuary Program experience Inventories Rapid assessment techniques Data and information nodes GIS applications and online mapping Remote conferencing
Area planning	Special area management planning (SAMP) process with examples Coastal land use planning Development buffers and setbacks Shoreline and marine zoning Waterfront revitalization National Estuary Program processes
Regulatory measures	Permit programs One-stop systems Advance planning for permitting
Nonregulatory measures	Conservation easements Transferable development rights Financial incentives
Land and water area management	Direct land management, e.g., National Wildlife Refuges, parks and seashores, Estuarine Research Reserves Land trusts Incentive-based programs, e.g., Wetlands Reserve Program
Public and user education for resource management	Interpretive signage and displays Regulatory signage Private sector collaborations, e.g., through the tourism industry University-based outreach
Ecosystem restoration, enhancement, and creation	Watershed restoration Species and habitat restoration Invasive species control Estuary and streams rehabilitation
Citizen engagement	Volunteer training and monitoring Marine and watershed stewards programs Watershed councils and associations
Coordination and collaboration	Inter- and intra-governmental coordination Public-private sector partnerships Area-based collaborations Policy-based tools, e.g., federal consistency Regional organizations

■ **The committee recommends that coastal management organizations and agencies increase the use of communication technology for real-time, distributed learning.**

Some real constraints to learning in coastal management are workload demands and limits on travel funds to attend workshops and conferences—highly valued learning venues. The committee recommends increased experimentation with the design and execution of large-scale video conferencing to expand the audience and access to national conferences and workshops on coastal management practice. The committee envisions national events with regional and local counterparts, as well as interactive participation from a variety of sectors.

The committee recommends that national coastal management agencies and organizations—NOAA, the USEPA, the Coastal States Organization, and others—work with their local clients and with nongovernmental organizations and the private sector to develop a five-year plan to advance the use of current and emerging communication technologies in new, modified, or expanded learning networks. The cost of the technology is not a major issue, given available communication systems and software at universities, community colleges, state capitals, and on individuals' desktops at work and at home. Conference or workshop design for effective learning will be the biggest challenge and may require considerable experimentation and evaluation.

■ **The committee recommends that organizations institutionalize a learning process about interactions between technology and coastal management.**

Because of the rapid advances in communication, information, and sensor technologies, the committee recommends that the NOAA Coastal Services Center, in collaboration with the Cooperative Institute for Coastal and Estuarine Environmental Technology, OCRM, the USEPA, and Sea Grant, establish and deliver a workshop series on Coastal Management and Emerging Technologies. We envision an event every two or three years that brings together practicing coastal managers (and their information needs and desires), applied coastal management technologists (e.g., Coastal Services Center staff, other agency and organization specialists), and pure technologists. Themes might differ from workshop to workshop, but the overall purposes would be to learn from one another, match needs and desires with potential technological solutions,

develop pilot project proposals, and plan diffusion strategies for proven applications.

The Coastal Geotools Workshops, organized periodically by the NOAA Coastal Services Center, may be a prototype for what is envisioned as a more broad-based series. Such a workshop series should be led by a consortium of coastal management agencies at the national or regional level, but should also involve nongovernmental and private-sector organizations and professionals. Participation, particularly among coastal managers, should include leaders and line staff from local, state, regional, and national organizations and networks.

Although coastal managers have often lagged behind other constituencies in taking advantage of new technologies to share knowledge, they still have the potential to revolutionize their use of information to better protect coastal resources. These recommendations are a starting point, the beginning of a dialog, to move coastal management practice toward the goal of being *innovative by design*—where learning through our myriad networks is fully integrated into organizational cultures and individual practice.

