

PN-ACQ-591

**Coastal Management:  
What Are We Learning  
From U.S.  
and  
International Experience?**

**By Stephen B. Olsen**

October 1998

COASTAL MANAGEMENT REPORT #2218

**COASTAL RESOURCES CENTER**

*University of Rhode Island*

A

## Coastal Management: What Are We Learning From U.S. and International Experience?

Stephen B. Olsen  
Director, Coastal Resources Center  
University of Rhode Island  
Graduate School of Oceanography

### ABSTRACT

*Contemporary coastal management now has a three-decade history in the United States while programs in other nations extend back twenty years or more. This diverse body of experience teaches that the essence of the coastal management challenge lies in adding new dimensions of spatial and temporal integration to traditional sector-by-sector planning and decision-making. In addition, equity issues posed by the anthropogenic transformation of coastal environments, that are otherwise often ignored, must be confronted. Such forms of integration threaten the distribution of power among divisions of government and require unfamiliar forms of collaborative behavior. Thus, while the planning phases of a coastal management process are often completed, programs frequently fail to make the transition to effective implementation. The reasons for these failures are examined and strategies to improve the prospects of success are offered.*

### **The Expanding Experience in Coastal Management**

This paper is an attempt to set forth the principle features of successful coastal management programs as they emerge from looking back over almost three decades of experience in the United States and more recent initiatives in a growing number of other nations. My purpose is to identify those characteristics that appear to be most critical to coastal management programs that succeed in integrating diverse sets of information from the social and natural sciences, gain a place on the political agenda of a nation, and then build sufficiently strong constituencies to proceed to the effective implementation of their policies.

The body of U.S. experience that is relevant to such an analysis of coastal management is large and eclectic. It encompasses legislation and programs including the Clean Water Act (1972), the Coastal Zone Management Act (1972), the Fisheries Conservation and Management Act (1976), and the National Estuaries Management Program (initiated in 1987). At the individual state level it includes the 35 coastal zone management programs that have been formally approved for implementation by the federal government and 26 estuary management plans in various stages of formulation. The United States experience does not offer a formula for the effective management of coastal regions. It is an experience replete with both failures and some notable successes. It reveals many useful lessons for others undertaking the complex challenge of striking a balance between man and nature at the boundary between terrestrial and marine systems.

The experience of the United States is complimented by coastal management initiatives in a number of other high-income nations—such as the Netherlands—and by a growing number of programs in low-income nations in the tropics where the pace of change in coastal ecosystems is most rapid. Sri Lanka's Coastal Zone Management Act was enacted in 1981. Costa Rica has been administering its Ley de la Zona Maritimo Terestre since 1976. According to Sorensen (1997), there are now more than 180 coastal management programs, projects and feasibility studies in both high and low income nations.

In 1985, the United States Agency for International Development (USAID) launched two programs to assess whether the experience in grappling with the problems of coastal management in the United States could be usefully adapted to the problems of tropical, low income nations in the tropics. One project, implemented by the University of Rhode Island's Coastal Resources Center, supported initiatives in Sri Lanka, Thailand and Ecuador for nearly ten years. The second, administered by ICLARM worked in the nations of the ASEAN region. These two bodies of experience will be examined in a forthcoming issue of the journal *Ambio*.

As other nations consider initiating integrated coastal management programs they will be well served by critically examining this rapidly growing body of experience. It teaches, I believe, that coastal management is above all a challenge of integrating formerly isolated academic disciplines and economic sectors by creating new governance systems. These more integrated systems of governance attempt to respond to both the immediate and long-term needs of coastal societies in geographically defined places by combining participatory democracy with an understanding of how ecosystems function and respond to anthropogenic pressures.

### **The Limitations of Sector by Sector Management**

A defining feature of coastal management is that it addresses the allocation of resources and the interactions among often competing uses within specified geographic areas.

Coastal management is therefore a form of regional planning and has many parallels in such fields as river basin management and integrated rural development. Coastal management is made different (1) because the diversity of uses and the issues raised by the conflicts between competing user groups are particularly intense and (2) because coastal management addresses areas that contain both coastal lands and coastal waters. The competition between different human activities is intense because global databases tell us that approximately half of the human population (Cohen et al., 1997) and an even larger share of the infrastructure required to sustain contemporary human society are concentrated in coastal regions. The predictions are that the density of people and infrastructure will increase even more (World Bank, 1996) as the global population expands from the current 5.8 billion to approximately 10 billion by the middle of the next century.

The features and the consequences of anthropogenic change to coastal regions appear to follow recognizable patterns. The social and environmental consequences of industrial fishing, the sequence of changes that occur if an area evolves from small scale occasional tourism to massive resort centered tourism, the consequences of ever greater fertilization of estuaries with nutrients from sewage and agriculture, the reengineering of the hydrology of coastal lagoons are expressions of the anthropogenic transformation process that follow repeating patterns and produce predictable impacts—both positive and negative. Influencing these trajectories of change cannot be done within the confines of traditional sector by sector management. An additional layer of organization and of collaborative behavior is required that does not replace sectoral management but adds a new dimension to it.

In the United States, the recognition that integrated approaches to the issues posed by ecosystem change and economic development can be traced back at least as far as the 1860s. During that period, formally abundant coastal fisheries in New England suffered the first in what became a series of dramatic declines. An inquiry commissioned by the federal government concluded that a viable approach to the analysis and adequate response to such a problem required bringing together the management of fisheries resources, the management of land use, and the management of water quality (Baird, 1873). Similar conclusions were repeated in the years that followed but it was not until the 1960s when concern for a widespread perceived decline in environmental quality was high on the national agenda that a number of studies concluded that the estuaries along all of the United States' coasts were becoming seriously degraded and that a new approach to their management was urgently needed. The Stratton Commission report looked to the future and saw new uses and new benefits that also required new approaches to coastal management. It was this report that recommended a national Coastal Zone Management (CZM) program.

### **Integration Through Coastal Zone Management**

In the United States, the national coastal zone management legislation adopted by Congress in 1972 was originally seen as the junior partner to far more ambitious legislation that would have reformed land use management nationwide. The land use legislation that was debated with the CZM bill was not enacted. The coastal management program therefore had to be implemented without the support of broader effort in land use reform. The approach taken by the federal coastal zone management program in the United States was innovative and in many ways experimental. Its defining features are sometimes forgotten and are worth recalling when considering how this body of experience may be adapted to conditions in other countries. It is first important to recognize that the United States operates as a federalist system where considerable power and authority resides with the individual states. In particular, authority to regulate the use of privately owned land, inshore waters and inshore fisheries resides with the individual states. In many states, such authority has been further decentralized to municipal or county government. Coastal management in the United States has had to recognize this decentralized governance system. Within this context, the major features of the coastal management program may be summarized as follows:

- (1) The program is voluntary; it emphasizes the process by which planning occurs and the procedures by which development decisions are made and emphasizes that the federal government will not “second guess” a state on specific land and water use decisions subject to an approved CZM program.
- (2) The federal government encourages individual states to participate in the program by offering two major incentives. The first is funding for planning and then, if the state program meets rigorous federal standards, larger financial contributions for implementation. The second incentive is more unusual and is a commitment to make federal actions consistent with an approved state coastal management plan. This decentralized approach assures that the “ownership” of coastal management initiatives rests with state and local government. More recently this idea has been termed the subsidiary principle. It states that nothing should be done centrally if it can be done equally well, or better, locally.
- (3) The federal government requires an unprecedented degree of public involvement in the planning and decision-making process. The framers of the legislation believed that the cross-sectoral approach that integrates needs for both development and conservation will require a high degree of public support if it was to be implemented effectively. The coastal management program’s emphasis on public involvement and transparency in the governance process—although initially resisted by some governmental agencies—is now recognized as a central feature of the most successful CZM programs.
- (4) In the initial stages of implementing the Coastal Zone Management Act, a major emphasis was placed on a comprehensive approach to planning and management. The first state programs therefore assembled voluminous inventories and surveys of resources and activities within a state’s designated coastal zone. Gradually it was learned that such compilations of information too often are of little practical

usefulness to management. This led to an issue-based approach to planning, research and public involvement. This evolution to an issue-based focus can be traced in the sequence of amendments to the federal legislation that have defined more clearly the specific topics that state programs should address.

- (5) A major concern for those that framed the legislation was that a locally driven management process would fail to accommodate national interests. The solution lay in requiring that state coastal management programs work with the individual federal agencies to define in specific terms, and where appropriate to map, those areas in which there was a significant federal interest. Federal lands designated through this process are exempt from the provisions of state CZM programs. The state CZM policies and plans must recognize and accommodate the other national interests identified.
- (6) Financial incentives to the states were divided into two categories. Planning grants were made available for up to four years. The goal of the planning process, however, was always to develop plans and policies that would meet detailed federal standards for the formal approval of a state's CZM plan. Federal approval required formal endorsement of the plan by the state's highest authority—the governor—and demonstration that the authorities were in place by which the policies and plans could be effectively implemented. For many states, demonstration of an adequate institutional structure by which policies and plans would be implemented was by far the most difficult hurdle. In some cases, it required new state legislation. The state also had to demonstrate that it could meet its financial commitments for implementation and would match federal funds in support of implementation one for one.

In the author's opinion, the major impact of coastal management in the United States is that it has brought a measure of order and predictability to the development process along the nation's coastlines. A persuasive argument can be made that the number of "development mistakes" and the incidence of "needless" environmental degradation and "avoidable" conflicts among user groups that concerned those who framed the federal legislation in 1972 has indeed declined as a result of the implementation of state CZM programs. By no means, however, have conflicts been eliminated nor in many instances has the gradual erosion of ecosystem qualities ceased. It is very difficult, however, to "prove" either of these assertions. One problem is that without pre-established control sites it is impossible to demonstrate with assurance that conditions would have been worse today if investments in coastal management had not been made. The second problem is that no rigorous attempt was made to document baseline conditions when coastal management was initiated and then consistently monitor those variables by which an objective assessment of program impacts could be made. These are the conclusions of a recent national assessment that attempted to document the outcomes of coastal management programs as these relate to such priority issues as public access to the shore, wetlands protection.

The constraints under which coastal zone management programs have operated are seldom fully appreciated by external observers. The degree of intersectoral integration that was possible through CZM programs was severely limited. The management of water quality has remained the purview of state agencies overseen and funded by the Environmental Protection Agency. The management of fisheries resources remains under the control of state fish and game agencies within a state's territorial waters and federal fisheries management organizations further offshore. A CZM program's authority over land use decisions is usually severely limited since the regulation of land use is a jealously guarded prerogative of local government. Much energy is expended on interagency consultation and coordination and in negotiating conflicts between agencies with different sectoral mandates (horizontal coordination) and between municipal, state and federal levels of government (vertical coordination). Thus the integration into a single coherent program of the management of land use, water quality and fisheries called for more than a century before by the Bard Commission has remained elusive.

A second generation of coastal management in the United States has been expressed through the national estuaries management program. These programs are administered by the national Environmental Protection Agency rather than the National Oceanographic Atmospheric Administration which houses the federal unit that oversees CZM programs. This second program is the subject of a companion paper by Dr. Timothy Hennessey. I will note, however, that this is another body of experience that bears careful examination. It strongly reinforces the benefits of an issue driven governance process with a strong emphasis on the active participation of interested stakeholders both within and outside of government.

### **The Challenges of Integrated Approaches**

The debates that have accompanied the framing of CZM legislation in the United States and the subsequent demonstration that individual state programs have adequate authority and funds to implement integrating policies has repeatedly reinforced that any departure from tradition sector by sector management raises a host of institutional issues and conflicts. Integrated approaches are invariably perceived by the existing national and local governmental institutions as a threat to their power and their prerogatives. Thus the practice of any form of coastal management is always dominated—particularly in a first generation program—by institutional issues. The perception that an integrated approach threatens existing institutional traditions is caused first by the necessity to bring together disparate institutions that have never before had to collaborate. Depending on the setting, these may span agencies responsible for agriculture and irrigation, tourism, highways, ports, parks and protected areas and water supply and sanitation and the Navy. But an integrated approach requires more than interagency collaboration. It demands shifts in traditional ways of thinking. For example, at the core of debates over sustainable development is the troubling idea that decisions made today may be reducing the ability of future generations to meet their needs. To these long-term temporal dimensions of integration must be added more immediate issues of social equity. Invariably the development process brings benefits to some groups but not to others. Integrated approaches to planning and management require that such trade-off be analyzed, debated and consciously decided. When a governmental agency can focus on only one sector and one group of stakeholders, this often-uncomfortable topic of trade-offs can be pushed to the side. This is why in the United States such issues as

public access to the shore and the protection of socially and culturally important sectors such as fisheries that are water-dependent and require facilities on the waterfront but must compete with more powerful interests have become major—often divisive—topics with which a coastal management program must struggle.

Because of the difficulties outlined above, a disturbing number of the coastal management initiatives that are being launched along the world's coastline are failing to proceed into a period of meaningful implication. In the great majority of cases, the analysis of issues and the technical quality of the resulting plans and new legislation are technically good. But in many cases they are politically naïve and they fail to gain the authority and financial support that effective implementation requires. This suggests that the most critical decisions that must be made when framing a new coastal management initiative lie in selecting an initial agenda that can survive the transition from planning to implementation.

Since the amount of integration that is attempted is a strategic issue of central importance, it is helpful to consider the options (Olsen, et al., 1997).

- *Enhanced Sectoral Management*: Focuses upon the management of a single sector or topic but explicitly addresses impacts and interdependencies with other sectors and the ecosystems affected.
- *Coastal Zone Management*: Multi-sectoral management focused upon development and conservation issues within narrow, geographically delineated stretches of coastline.
- *Integrated Coastal Management*. Expands the cross-sectoral feature of CZM to consideration of the closely coupled ecosystem processes within coastal watersheds and oceans. These programs are conceived as a means for progressing towards sustainable forms of development.

One of the most important lessons that is emerging from worldwide experience in coastal management is that from a pragmatic political and operational point of view more integration is not always better than less integration. In many cases, success lies in modest beginnings. It may be strategically far better to begin with enhanced sectoral management and then proceed to a well-focused coastal zone management program before attempting the far more complex integrated coastal management program. This does not mean that the holistic and long-term world view that is required by ICM should be put aside. But from a strategic, operational point of view, it is far better to implement a few things well than to launch into an overly ambitious multifaceted program which produces negligible progress on many fronts. Deciding on how much integration to attempt should be related to the institutional complexity and diversity of interests of the area in question. On a relatively undeveloped coastline with a low population density beginning with ICM may indeed be a feasible option.

### **Coastal Management in Developing Nations**

The benefits of a limited but well executed agenda are well illustrated by the Sri Lanka coastal management program. This program was launched by legislation adopted in 1981. Although the program has a broad mandate to address a wide range of activities in coastal waters and a narrow strip of coastal land, the program began by focusing its resources on a single but important issue (Lowry and Wickremaratne, 1989). This was coastal erosion and those human activities that are most directly affected by coastal erosion—such as beach resorts and transportation infrastructure—and such activities as sand mining, coral mining, and shoreline hardening that exacerbate erosion processes. The strategy adopted by the Coast Conservation Department was to develop public and political support by demonstrating tangible progress on this important issue. The agenda was gradually broadened to include policies for the protection of habitats and important cultural and religious resources. In 1990, the program added the dimension of special area management plans that extend inland from the narrow strip under direct regulatory authority of the coastal program and examined the many activities and competing interests within geographically small, but important, coastal areas.

The many donor-supported coastal management initiatives now underway in the tropics are adopting a pilot project strategy that focuses the financial and technical resources of an initiative on small demonstration sites. The ultimate success of this strategy, however, and the justification of the resources being expended lies in “scaling up” from these localized initiatives to programs that will address an integrated approach to management at a larger scale. This strategy has many benefits but it requires sowing the seeds for an integration of small-scale community-based efforts at integrated management with national initiatives with the same goal. In many countries that have adopted this strategy, making the link between such demonstration sites and national government is proving difficult.

The growing international interest in coastal management has led to a proliferation of guidance documents on the why, the what and the how of coastal management (OEDC, 1993; World Bank, 1996; IWICM, 1996; GESAMP, 1996). In its most essential and stripped down form, this process by which projects and programs evolve can be described as a cycle with the same features of other institutional endeavors (Figure 1). It begins (Step 1) by identifying and analyzing the resource management issues posed by the coast in question, and then proceeds to define management objectives and prepare a set of policies and actions (Step 2). Next comes Step 3 of formalization through a law, decree or interagency agreement and the securing of funds for implementation. Policy implementation (Step 4) is when the procedures and actions planned in the policy formulation stage are made operational. Step 5 calls for program adjustment and formal evaluation. In this step, the results of the management process are compared with the desired outcome(s). A completed cycle may be termed a generation of a program. This simplified version of the process was put forward by GESAMP (1996) and the actions associated with each step have been elaborated by Olsen et al. (1997a) and used as the organizing framework for a self-assessment manual (Olsen et al., in Press). This conceptual framework for charting the process by which coastal management projects and programs evolve is useful to promoting an adaptive, learning based approach to coastal management and to assessing the strengths and weaknesses of individual initiatives according to an explicit set of standards.

An analysis of international experience makes it clear that it is sometimes necessary to take the steps out of order, most commonly by passing legislation (Step 3) before detailed policies, plans and procedures have been negotiated (Step 2). Such variations may bring a price in terms of the efficiency and the effectiveness of the overall process. A common mistake is to embark on a protracted planning effort without a clear definition of the goals of the exercise or a careful decision on the issues that such planning is designed to address. One of the most significant limitations of many coastal management initiatives is that Step 5, evaluation, is either omitted or completed in a cursory manner. Most formal evaluations of donor funded projects focus upon performance evaluation—i.e., the degree to which the specific, usually short-term objectives of that project have been completed—rather than gauging the capacity of the institutions involved to successfully execute further work or to assess the outcomes of the effort (Olsen et al 1997b).

Experience in integrated approaches to coastal management also suggests that it is useful to assign the outcomes of initiatives to a sequence of events that lead logically to the ultimate goal of sustainable forms of coastal development (Figure 2). This manner of relating the expectations for a programs to its maturity and former achievements reinforces can be very helpful when in setting realistic expectations for a short term effort. Thus, initial outcomes may be expected to take the form of improved governance process such as collaboration among institutions of government, a more transparent and efficient decision making process, and more effective stakeholder participation in a new, formally constituted, governance process. It is only later that we can expect to see significant changes in societal behavior (second order outcomes) – such as declines in destructive forms of fishing or a reduction in corrupt practices in the granting of permits. These, in turn may be followed by improvements in such social and environmental indicators (third order outcomes) such as recovered fish stocks and and greater equity in the allocation of public resources. Unfortunately, many of the coastal management initiatives underway today are designed with the expectation that they will achieve second and third order outcomes within a few years. This may indeed sometimes be possible at a small pilot project scale. But achievements of such outcomes at significant geographic scales in populous coastal regions supporting large number of competing activities will occur in time periods measured in decades.

### **The Governance of Ecosystems**

My own experience of working on the design and execution of CZM programs in the United States and then as an advisor to a number of ICM programs in developing nations has lead me to believe that there are fundamental differences between these two forms of coastal management. The differences are rooted in how the goal is articulated. Even though the United States federal CZM legislation makes reference to benefits for “this and succeeding generations,” the operational reality in CZM is that these programs work to avoid “development mistakes” and to bring greater order and predictability to the contemporary coastal development process. The trajectory of the development process itself is not questioned. ICM defines the goal as making progress towards sustainable forms of development. If we take the concept of sustainable development seriously – and many do not – it raises the possibility that actions today may be reducing the prospects for future generations to meet their needs. Sustainable development therefore requires that we critically re-examine the long-term implications of the contemporary development process and expand the analysis of equity issues to include future generations. It places greater emphasis on

societal and ecosystem qualities that are not amenable to market valuation. This poses greater challenges of integrated analysis and can lead to conclusions that are radically different from those reached when we assume that economic growth is good and that development decisions should be based on near term calculations of economic benefit and cost. Such ideas are being vigorously debated in some circles and can be explored in the writings of such authors as Daly (1996) and Costanza (1997 and 1997a). Herman Daly has suggested that the defining feature of sustainable development is the replacement of quantitative expansion (growth) with qualitative improvement (development) as the path of future progress. This is indeed a radical departure and its implications are beyond the scope of this paper. Another fundamental precept of this interpretation of sustainable development is that it views ecosystems and human societies as fully integrated and interdependent systems.

So far, attempts to practice coastal ecosystem management at significant scales have not been motivated by the desire to achieve sustainable forms of development but rather to restore severely degraded estuaries, lakes, and enclosed seas. Such efforts, however, raise the issues posed by sustainable development since ecosystem management at these scales illustrate how human activity can outstrip the capacity of the our life support system to sustain qualities that are important to societal well being. The North American Great Lakes illustrate the progress that can be made even when international collaboration is required. Efforts to restore water quality, fisheries and the aesthetic values of the Chesapeake Bay has inspired the estuaries management program in the United States that may be viewed as a "second generation" of coastal management in the United States that is discussed in a companion paper by Hennessey and others. Other notable examples of attempts at coastal ecosystem management are to be found in initiatives that address such highly degraded water bodies as the Black Sea and the Baltic Sea. All of these efforts demonstrate the potential power of integrated analysis and integrated management at the scale of large coastal ecosystems as well as the enormous costs of even partially restoring the former qualities of trashed ecosystems. The greatest promise of ICM probably lies in its potential to predict and avoid such losses in ecosystem quality with their serious social and economic consequences. We are, however, a long way from making such proactive ICM practice operational at significant scales, particularly in developing nations where the pace of coastal change is most rapid and the consequences for major elements of the affected society are negative.

### **Some Potential Lessons for Korea**

Korea's coastline has been experiencing the expressions of the anthropogenic transformation that are manifest at various levels of maturity in other regions of the world. In Korea, much of this change has occurred rapidly and the impacts are therefore more dramatic than they are in places where the process has unfolded more gradually. Korea is about to enact its first coastal management legislation and now faces the challenges posed by the transition from issue analysis and planning to the implementation. A number of lessons can be extracted from international experience that may have some relevance to how Korea meets the challenges of implementing its new coastal policy.

- (1) Coastal management initiatives of all varieties prevail and with time expand their influence when they have strong constituencies both within government and among important stakeholders in the private sector. The strength of constituencies is directly

related to the degree to which those that are affected by a coastal management program feel ownership for it. This fundamental reality is leading a number of institutions to pursue a "two-track" strategy that works consciously to build constituencies for coastal management simultaneously at both the local and the national levels. Many successful coastal management initiatives have begun with a national commitment and strong leadership by a national institution. In most cases, success for programs initiated by central government has lain in investing in initiative and commitment at the local level. The U.S. experience, however, underscores that it is essential to make provisions for recognizing and accommodating the national interests in plans and decision-making processes that are "owned" by local government.

- (2) The difficulty of translating the principles of integrated approaches to effective action calls an iterative governance process. Progress is limited primarily by the limited capacity of the institutions responsible for program implementation and the limited power of the constituencies that support a coastal management program. These realities suggest that programs will succeed only when they are sustained over many decades. Progress can be visualized as a sequence of completions of the ICM policy cycle. The strategy should be to increase the scope of each generation of a program by adding new issues to the agenda and/or expanding the geographic scope of the program. It is a fundamental mistake to believe that the goals of a national coastal management program will be achieved in a single cycle. There are many implications to this. The most important is that a program must be designed around a dedication to learning. This requires an adaptive approach to management. Opportunities must be created for reflection and a critical examination of the successes and weaknesses of a program's strategies and to changes in the issues demanding attention in the places where the program is operating. The flexibility that is required by a program that is based upon learning is unusual among governmental institutions at any level. Incentives for such behavior must therefore be written into the design of a program.
- (3) More integration is not always better than less integration, particularly in first generation programs. It is usually better to focus a young coastal management program on a limited agenda directed at a few coastal management issues nationwide or on a more comprehensive approach that is limited to a small geographic area. It is essential that a program demonstrate that it is capable of producing tangible benefits quickly. Since the sequence of coastal management outcomes makes it highly unlikely that immediate progress will be made in terms of changes in societal behavior or changes in the condition of coastal ecosystems, the benefits that a young coastal management program can deliver usually lie in the realm of an improved governance process. Successes in public education and public involvement, in improved coordination and collaboration between local and central government and between governmental agencies and the private sector are likely to be perceived as very real and important advances. The demonstration site strategy is a good one so long as links are maintained between the pilot site and national government.

- (4) One of the many reasons for adopting an approach to coastal management that emphasizes public participation and seeks to win the support of the user groups and communities that are affected by the program is that implementation strategies that rely primarily on command and control can seldom be sustained. Successful programs that address the usual coastal management topics are implemented because a significant portion of the people affected believes in them. This produces the voluntary compliance and even self-enforcement that are the hallmark of any successful attempt to institute a change in societal values and societal behavior.
- (5) One of the hard won lessons in the various forms of coastal management in the United States is that science informs but does not drive the management process. This lesson was repeated in the eight pilot projects administered in the ASEAN region by ICLARM between 1984 and 1989 (Thia-Eng and Scura, 1992). The analysis of existing information and the framing of new research designed to support a management initiative requires that resource managers and scientists work together to frame the issues that must be analyzed. When research is designed to respond to the interests of individual researchers, the results are less likely to be of practical usefulness to those responsible for a management initiative. The massive failures in fisheries management in many parts of the world illustrates the dangers of an over-reliance on science and unrealistic expectations for the degree of "scientific certainty" required when making sound management decisions. A controversial paper by Ludwig et al. (1993) concluded from a review of fisheries management efforts that managers must act before scientific consensus is achieved.
- (6)
  - Confront uncertainty. Once we free ourselves from the illusion that science or technology (lavishly funded) can provide a solution to resource or conservation problems, appropriate action become possible.

This warning applies equally well to those considering the roles of the sciences in coastal management.

- (7) Finally there is much to learn from the experience of others. It is particularly instructive to examine failures and the constrained success of attempts at integrated management in other nations and a diversity of cultural and environmental settings. Since coastal management is an iterative and learning-based endeavor, there are no blueprints. Programs must be designed and refined place by place. Yet the issues that these programs address are remarkably consistent in all parts of the world. The skill of coastal management practitioners lies in selecting the scope of a program for a given place at a given time and in tailoring the approach to the unique characteristics of that place. Each program must have its own unique identity if its successes are to be sustained.

## References

- Baird, 1873. Report of the Commissioner 1871-72. The United States Commission on Fish and Fisheries.
- Cohen, J.E., Small, C., A. Mellinger, J. Gallup, and J. Sachs. 1997. Letter: Estimates of Coastal Populations. In: *Science*, 14 Nov. 1997.
- Costanza, R., J. Cumberland, H. Daly, R. Goodland, and R. Norgaard. 1997. An Introduction to Ecological Economics. St. Lucie Press, Boca Raton, FL.
- Costanza, R., R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R.V. O'Neill, J. Paruelo, R.G. Raskin, P. Sutton and M. van den Belt. 1997. The Value of the World's Ecosystem Services and Natural Capital. In: *Nature*, Vol. 387, 15 May 1997.
- Daly, H.E. 1996. Beyond Growth: The Economics of Sustainable Development. Beacon Press, Boston, USA.
- GESAMP (IOM/FAO/UNESCO-IOC/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). 1996. The Contributions of Science to Integrated Coastal Management, GESAMP Reports and Studies No. 61, 66 pp.
- IWICM (The International Workshop on Integrated Coastal Management in Tropical Developing Countries). 1996. Enhancing the Success of Integrated Coastal Management: Good Practices in the Formulation, Design and Implementation of Integrated Coastal Management Initiatives. MPP-EAS Technical Report No. 2, 32 p. GEF/UNDP/IMO, Quezon City, Philippines.
- Lowry, K. and H.J.M. Wickremaratne. 1989. Coastal Area Management in Sri Lanka. Coastal Management, Ocean Year Book 7, University of Chicago. P. 263-293.
- Ludwig, D., R. Hilborn and C. Walters. 1993. Uncertainty, Resource Exploitation and Conservation: Lessons from History. In: *Science*, 260, 17, 36.
- OECD. 1993. Coastal Zone Management: Integrated Policies. Organization for Economic Cooperation and Development, Paris.
- Olsen, S., K. Lowry, J. Tobey, P. Burbridge and S. Humphrey. 1997. New UNDP Survey on Coastal Management Initiatives. Intercoast Network No. 29, Fall 1997. Narragansett, RI, USA.
- Olsen, S., J. Tobey, and M. Kerr. 1997(a). A Common Framework for Learning from ICM Experience. In: *Ocean & Coastal Management*, Vol. 37, No. 2, pp. 155-174.
- Olsen, S., K. Lowry, J. Tobey, P. Burbridge, and S. Humphrey. 1997(b). Survey of Current Purposes and Methods for Evaluating Coastal Management Projects and Programs Funded

by International Donors. Coastal Management Report #2200, available through the Coastal Resources Center, University of Rhode Island, Narragansett, RI.

Olsen, S. K. Lowry and J. Tobey. (In press). A Manual for Assessing Progress in Coastal Management. Coastal Resources Center Report #2210, University of Rhode Island, Narragansett, RI, USA.

Sorensen, J. 1997. National and International Efforts at Integrated Coastal Management: Definitions, Achievements, Lessons. In: *Coastal Management Journal*. Vol. 25, #1, Winter 1997.

Thia-Eng, C. and L.F. Scura. 1992. Integrative Framework and Methods for Coastal Area Management. ICLARM Conference Proceedings 112, Manila 0818, Philippines.

World Bank. 1996. Guidelines for Integrated Coastal Zone Management. J. Post and C. Lundin (eds.). Environmentally Sustainable Development Studies and Monograph Series No. 9. The World Bank, Washington, D.C.