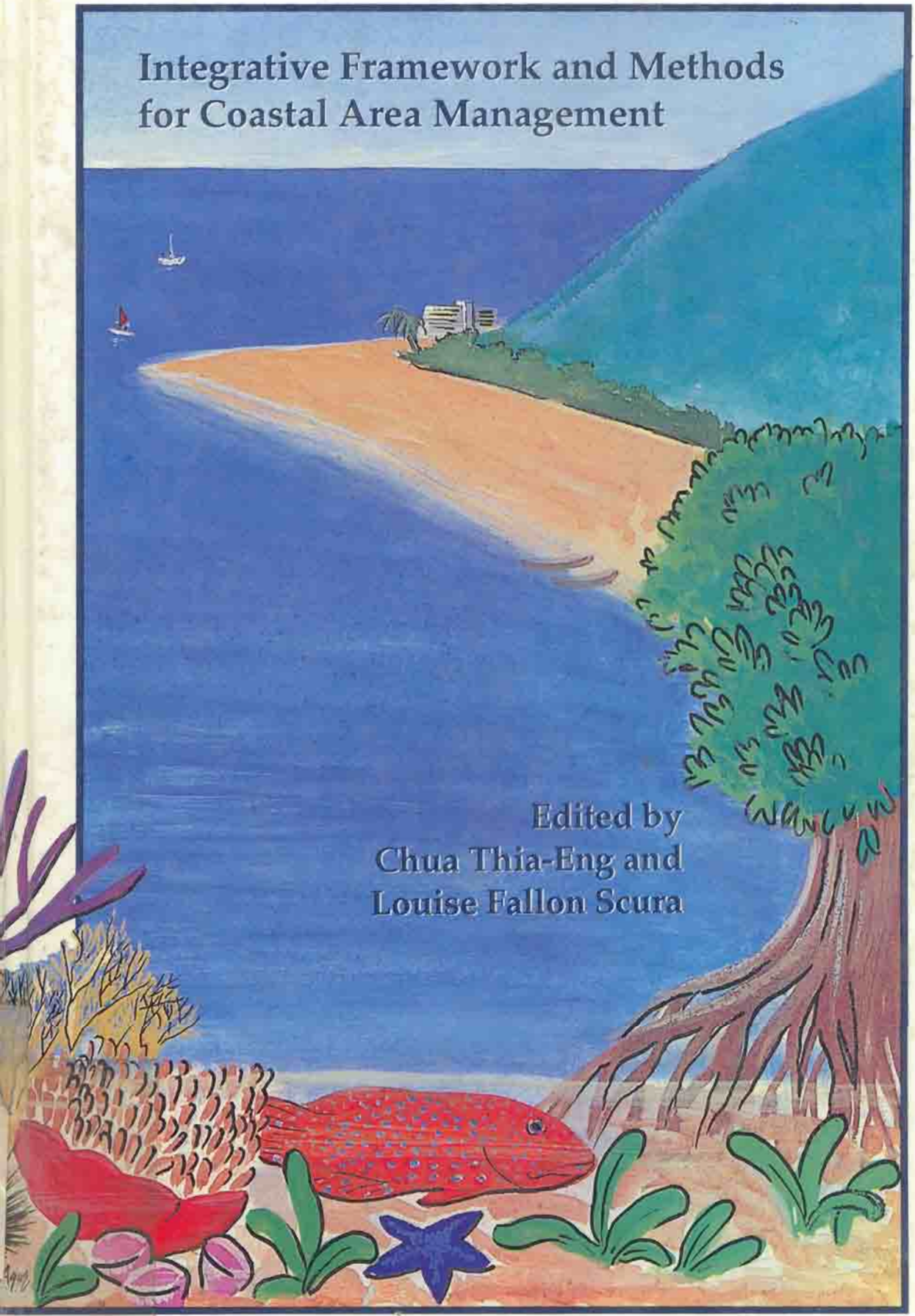
Integrative Framework and Methods for Coastal Area Management



Edited by
Chua Thia-Eng and
Louise Fallon Scura

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Proceedings of the Regional Workshop
on Coastal Zone Planning and Management
in ASEAN: Lessons Learned
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Preface

The coastal areas of Southeast Asian countries are some of the world's richest ecologically, characterized by extensive coral reefs and dense mangrove forests. Blessed with warm tropical climate and ample rainfall, the coastal waters are enriched with nutrients from the land which enable them to support diverse and abundant marine life. Because economic benefits are derived from them, the coastal areas teem with human settlements. Over 70% of the population in the region lives in coastal areas where resources have come to be heavily exploited. This situation became apparent during the 1960s and 1970s when population and socioeconomic pressures significantly increased. The resultant large-scale exploitation of the region's valuable resources and serious degradation of the environment have affected adversely the economic welfare of the coastal inhabitants. This lamentable situation is mainly the result of the absence or inefficacy of coastal management.

Some of the economies in the Association of Southeast Asian Nations (ASEAN) are natural-resource dependent, mainly involving coastal activities such as fishing, aquaculture, agriculture, forestry and salt-making, to name a few. Other economies are more diversified or in transition, and include coastal activities such as tourism, tin mining, oil drilling, shipping and industrialization. Well-intended efforts to develop and diversify economies can inadvertently result in conflicts with existing economic activities.

Coastal resources are valuable assets that can effectively contribute to sustainable development. Nevertheless, unisectoral overuse of some resources has caused grave problems. Indiscriminate logging and mining in upland areas might have brought large economic benefits to those undertaking these activities and, to a certain extent, increased government revenues, but have proved detrimental to lowland activities such as fisheries, aquaculture and coastal tourism. Similarly, unregulated fishing effort and the use of destructive fishing methods, such as mechanized push-nets and dynamiting, have destroyed fish habitats and reduced fish stocks. Indiscriminate cutting of mangroves for aquaculture, energy, building materials and the like has brought temporary gains in fish production, fuel wood and timber supply but losses in nursery areas of commercially important fish and shrimp, coastal erosion and flood protection.

Some ASEAN members have formulated regulatory measures for their resources management such as the issuance of permits for fishing, logging and mangrove harvesting. However, most of these measures have proven ineffective due partly to enforcement failure, but largely to lack of support from the communities concerned.

Experiences in coastal area management (CAM) in developed nations suggest the need for an integrated interdisciplinary and multisectoral approach in developing management plans for the coastal areas.

The ASEAN/United States (US) Coastal Resources Management Project (CRMP) arose in response to the existing CAM problems. Its goal is to increase capabilities within ASEAN for developing and implementing CRM strategies. Co-funded by the US Agency for International Development (USAID) and ASEAN and executed by the Coastal Area Management Program (CAMP) of the International Center for Living Aquatic Resources Management (ICLARM) in cooperation with national institutions, the project attempts to attain its goals through these activities:

- analyzing, documenting and disseminating information on trends in coastal resources development;
- increasing awareness of the importance of CAM policies and identifying, and where possible, strengthening existing management capabilities;
- providing technical solutions to coastal resource-use conflicts; and
- promoting institutional arrangements that bring multisectoral planning to coastal resources development.

In addition to implementing training and information dissemination programs, CRMP has developed site-specific CAM plans containing integrated strategies that could be implemented under the prevailing conditions in each nation.

The Regional Workshop on Coastal Zone Planning and Management in ASEAN: Lessons Learned, held in Bandar Seri Begawan, Brunei Darussalam on 28-30 April 1992 endeavored to pool the insights and experiences gained in the CRMP planning process. The conference was attended by approximately 50 participants, largely composed of resource and scientific personnel from the region's universities, government agencies, and nongovernment organizations directly involved in CRMP. Also included were selected CAM experts from outside the region.

The principal objective of this conference was to critically review and assess the planning process used and the content of plans formulated as part of CRMP. Furthermore, it was intended to help future efforts in CAM by drawing lessons for priority setting and policy formulation regarding management issues and interventions.

Formal presentations and discussions were conducted in four sessions. The first session concentrated on integrated coastal zone management planning con-

cepts, while the second highlighted research experiences and discussed the pros and cons of selected diagnostic and analytical tools. The third and the final sessions were dedicated to synthesis and summary, and general discussions.

A total of 23 papers was presented at the conference, another 13 were used as bases for discussion and 2 more as background. Several contributions on selected topics have been included in this volume. The project management aspects of CRMP are reviewed by Chua, while Tobin provides an overview of institutional and organizational considerations in CRM. Papers on the use of specific methodologies, their opportunities and constraints, include those on remote sensing and GIS (Kam et al.), economic valuation (Pomeroy) and rapid appraisal (Pido and Chua).

The main paper in this volume (Scura et al.) is a distillation of lessons learned from the experience of CRMP. This paper draws heavily on the workshop discussion sessions for the ideas and concepts developed therein. It makes no attempt to chronicle CRMP, but rather seeks to document the salient lessons for future CAM endeavors.

The conference was co-organized by ICLARM's CAMP and Brunei Darussalam's Department of Fisheries, the national coordinating agency of its CRMP. The technical and support staff of CAMP served as the conference secretariat and helped in the production process. Ms. Marie Sol M. Sadorra, Ms. Rachel D. Africa, Ms. Cecille Legazpi, Ms. Pamela P. del Rosario and Ms. Regina G. Morales assisted in editing the manuscript; Ms. Rachel C. Josue and Ms. Eloisa E. Ben Belaid typed it; and Ms. Rachel C. Atanacio prepared the figures and the layout. The authors and editors are grateful to those who contributed in any way to the publication of this book.

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Lessons for Integrated Coastal Zone Management: The ASEAN Experience*

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Abstract

This paper draws on the 6-year experience of ASEAN/US CRMP to identify three general sets of lessons--process-related, development stage-related and institutional setting-related--and discuss their implications for research and management of coastal areas. The process-related lessons include the generally desirable characteristics of the planning process, the essential features of good coastal area management (CAM) plans and the critical roles of integration and coordination in planning and implementation.

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The development stage-related lessons imply a correlation among the occurrence of specific types of management issues, and stages and scales of economic development and urbanization. This paper asserts that, between the more traditional management issues involving rates and levels of resource exploitation and the more modern issues regarding pollution, a transitional stage occurs where there is dualism and synergism of these issues. The institutional setting-related lessons suggest that the choice of effective management interventions must be based on the existence of appropriate institutions and organizations.

Critical research needs are identified as improvement of analytical tools and enhancement of the information base used for prioritizing management issues and designing management policies. These should include explicit evaluation of the benefits and costs of tradeoffs among alternative coastal activities, and studies of the appropriateness, efficacy and cost-effectiveness of various management interventions in developing country settings.

An Unprecedented Testbed

In 1986, against the backdrop of serious resource overexploitation, environmental degradation and escalating resource-use conflicts resulting from the sectoral orientation of development and management in coastal areas, the six members of the Association of Southeast Asian Nations (ASEAN)--Brunei Darussalam, Indonesia, Malaysia, the Philippines, Singapore and Thailand--began a collaborative effort to develop integrated coastal resource management (CRM) plans in their respective countries. The six-year, US$5.8 million effort--the ASEAN/US Coastal Resources Management Project (CRMP)--received financial support from the United States Agency for International Development (USAID) and the technical assistance and international coordination of the Coastal Area Management Program (CAMP) of the International Center for Living Aquatic Resources Management (ICLARM).

The CRMP was a novel attempt. It was the first regional effort in coastal area management (CAM), and was organized by the ASEAN members themselves. While project management and coordination was provided by ICLARM, an independent international organization, the project coordinator was from one of the ASEAN members.

While the regional effort was designed and coordinated to address CAM problems common among the ASEAN members, it was necessary for each country to develop its own customized plan. Social and economic circumstances in each country determine to a large extent the occurrence of specific CRM issues. Similarly, the special political, cultural and other institutional conditions influence significantly the appropriate mix of management plan elements. In addition, likelihood of management plan implementation is increased significantly if the plan is developed from within.

In fact, the primary purpose of CRMP was to provide financial and technical assistance and to otherwise support and encourage the improvement of domestic abilities in technical, institutional and organizational approaches for managing

Box 1. Highlights of CRMP.

Site-Specific Coastal Management Plan Development

- Formation of multidisciplinary teams
- Formulation of workplans
- Preparation of site-specific coastal area profiles
- Conduct of issue- and opportunity-oriented research
- Formulation of CAM plans
- Adoption of management plans by governments

Training in and Creating a Constituency for Coastal Area Management

- Training
  - Degree
  - On-the-job
  - Short-term courses
- Regional Workshops
  - Red tides
  - CAM policy
  - CAM technical aspects
  - CAM education
  - Lessons learned
- Conferences
  - Policy
  - Waste management
- Publications
  - TCAM newsletter
  - Educational materials
  - Technical reports
  - Workshop and conference proceedings
  - Site-specific CAM plans

coastal areas in the participants' countries. The CRMP was divided into two complementary components: Component 1 focused on management plan preparation, while Component 2 emphasized human resources development and creating a constituency for change through public education and information dissemination (Box 1).

Pilot coastal sites were selected in the six countries and intensive, interdisciplinary planning programs were conducted, involving over 200 resource and scientific personnel from 49 institutions including universities, government agencies and nongovernmental organizations (NGOs). In addition, training courses, workshops and conferences were held, and publications and educational materials were disseminated as part of CRMP.

Approximately 120 nationals from ASEAN have been trained in subjects relevant to CAM as part of CRMP. These include young scientists who obtained master's degrees from U.S. universities, nationals who received on-the-job training in areas related to CAM, and numerous participants in six regional short-term training courses conducted by CRMP.

Also as part of CRMP, five regional workshops were conducted to address specific issues pertaining to CAM, and two major conferences were organized.

Through these forums, CRMP was extremely successful in promoting awareness among policymakers and the general public in the region, as well as among the donor community and the media, of the rationale for and efficacy of CAM. The first multinational commitment to CAM--the Baguio Resolution--was adopted by participants at a project-sponsored policy conference, comprised of key policymakers from each ASEAN member, as well as extraregional participants including technical experts, and representatives of the media and donor agencies (Box 2).

Box 2. Baguio Resolution on Coastal Resources Management: issued by the Policy Conference on Managing ASEAN's Coastal Resources for Sustainable Development, 4-7 March 1990, Manila and Baguio, Philippines.

WHEREAS, much of Southeast Asia's population lives in coastal areas, and the lives and reasonable aspirations for economic advancement of these coastal residents are inextricably linked to the sustained productivity of coastal resources; and coastal areas contain a diverse collection of natural resources within their interrelated ecosystems, and close linkages exist between these ecosystems and the socioeconomic systems in coastal areas; and fish and other aquatic resources are routinely captured and cultured in coastal areas, providing food, valuable chemicals and materials, employment and income for many coastal residents; and the region's unique coastal environments also provide many other economic opportunities for the private sector including oil, mineral and timber extraction, agriculture, shipping and tourism;

WHEREAS, many coastal environments within the Association of Southeast Asian Nations (ASEAN) have become seriously degraded, resource-use conflicts are escalating, and valuable coastal resources are being overexploited; and the result is that the productivity of these coastal areas has diminished, and the prospects for continued economic prosperity in the region has been jeopardized;

WHEREAS, to maintain and enhance the livelihood of coastal communities within the ASEAN, coastal areas must be managed for sustainable development; and as population and economic pressures on these coastal resources increase, it becomes more difficult and challenging to achieve sustainable development in coastal areas in the absence of proper management; and effective management of coastal areas requires that the ecological and socioeconomic interdependencies that characterize these areas be taken fully into account; and this can best be done through development and implementation of integrated coastal resources management plans;

WHEREAS, political leaders, and many groups and organizations have important roles in effective coastal resources management, and all of these can contribute to sustainable development; and government decisionmakers and the private sector can play a crucial role through their support of plan development and implementation, and their encouragement of coastal communities to act cohesively to enhance prospects for sustainable development of coastal areas; and donor agencies can likewise contribute meaningfully in setting the course of

Continued

Box 2. (continued)

development of coastal areas by ensuring that all sectoral projects funded are congruent with multisectoral development plans that are conducive to sustainable development of coastal areas; and the mass media are important in increasing public awareness regarding the importance of coastal resources and the dependence of continued prospects for economic development in coastal areas on proper management of coastal resources;

WHEREAS, recognizing the need for effective strategies to manage coastal resources for sustainable development, the ASEAN, through its various mechanisms, has undertaken a series of cooperative programs, particularly the ASEAN/US Coastal Resources Management Project; and under this project, the following activities have been undertaken by various national institutions coordinated by the International Center for Living Aquatic Resources Management:

- analysis, documentation and dissemination of information on how coastal resources are being developed for economic purposes;
- strengthening of existing management capabilities of local and national institutions within the region;
- provision of technical solutions to resolve conflicts arising from competing uses of coastal resources; and
- assistance to various organizations and agencies in the development of coastal area management plans;

WHEREAS, the Policy Conference on Managing ASEAN's Coastal Resources for Sustainable Development recognizes the accomplishments of the Coastal Resources Management Project;

Continued

A direct result of the Baguio conference was heightened interest at the policy level in the pursuit of resolutions to specific CAM issues. One issue common to all ASEAN members, waste management in coastal areas, was the topic of another project-sponsored policy conference held in Singapore. Similar to the Baguio conference, the Singapore conference had the broad participation of ministerial and cabinet-level decisionmakers, as well as donor agencies and the private sector. The resolution of the conference participants--the Singapore Resolution--includes a series of formal recommendations for specific policies on waste management in the coastal areas of the ASEAN region (Box 3).

Information dissemination was also an important emphasis of CRMP. Over 30 documents were published as part of the project, including conference and workshop proceedings, technical reports, educational materials and the CAM plans. In addition, the only international newsletter dealing with coastal management, *Tropical Coastal Area Management*, came out with 15 issues.

The most tangible and enduring accomplishments of CRMP are, in fact, direct outputs of the two project components--a critical core of technically competent and experienced CRMP personnel in ASEAN countries, and pilot-site specific,

Box 2. (continued)

THEREFORE, we, the participants of the Policy Conference hereby resolve and further recommend that the ASEAN member-countries, donor agencies and all other groups and organizations give emphasis to the protection of these resources for the primary benefit of coastal communities by:

- endorsing policies that promote and enhance sustainable development of coastal resources;
- encouraging the development and implementation of integrated, interdisciplinary and comprehensive coastal resources management plans;
- further strengthening management capabilities of governmental and nongovernmental organizations responsible for the management of coastal resources;
- undertaking measures to relieve human population pressures in coastal areas;
- implementing and rigorously enforcing effective regulations and supporting incentive schemes to promote sustainable uses of coastal resources;
- increasing awareness of coastal populations regarding their critical dependence on the continued productivity of coastal resources;
- promoting community-based participation in coastal area management;
- adopting policies and programs to enable women to participate in and contribute more actively to the effective management of coastal resources for sustainable development;
- exploring ways and means by which the public and private sectors can cooperate and thereby benefit from efforts to sustain and develop coastal resources; and
- considering in coastal area management, the implications of possible climate change and sea level rise.

ADOPTED by acclamation in Baguio City, Philippines, on 6 March 1990.

implementable management plans accepted by their respective governments and implementing agencies. In fact, the CRMP integrated coastal zone management (CZM) plans are among the few good examples of their kind in developing country settings. There are even fewer models of successful implementation of CAM plans in developing countries. The CRMP has laid the groundwork for a significant contribution in the implementation arena as well, though full-scale implementation was not intended as part of the project. In most of the participating countries, the CAM plans have been officially accepted by the government to some degree and moves have been made toward implementation.

For example, in Indonesia, the plan has been approved by the relevant planning authority in the pilot-site area; a task force has been formed to coordinate implementation; and several priority activities under the plan have begun to be implemented. Similarly, in Malaysia, the CAM plan has already been integrated into the state's town and country plans for implementation under the Sixth

Box 3. Recommendations of the Singapore Resolution on Waste Management in the Coastal Areas of the ASEAN Region, 28-30 June 1991, Singapore.

The participants at this conference agree that environmentally sound waste management strategies are vital to the sustainable development of coastal areas. As residents of the global commons and as citizens with clear opportunities to shape our nations' future, we recommend the following principles be incorporated into the environmental policies of ASEAN.

1. **ASEAN nations should cooperate:**
   a. to develop, harmonize and coordinate their waste management strategies and measures, including technology, manpower and information exchange;
   b. to monitor and assess the creation and disposal of waste that may affect their regional neighbors;
   c. to enhance the effectiveness of existing regional mechanisms concerned with transboundary pollution of coastal areas;
   d. to establish legal, financial, social and technical structures and capability which recognize the different economies of nations and which will eventually reduce dependency on external financing; and
   e. to ensure the availability of the necessary technical and financial assistance and manpower development objectives.

2. **Regional and national goals for environmental quality of coastal zones should be based on integrated coastal resources management strategies and should be defined in order to establish:**
   a. communication with the peoples of ASEAN in regard to the importance of appropriate waste management strategies to mobilize public support and participation;
   b. priorities for waste management measures, including those addressing sewage, garbage, industrial and agricultural waste, toxic substances, hazardous waste and environmental emergency planning and response;
   c. efficient use of financial resources;
   d. measurable objectives for desired uses of coastal areas;
   e. scientific and other environmental quality criteria needed to sustain these uses; and
   f. standards for environmental quality or environmental planning, as appropriate.

3. **Proposed activities or waste management measures that may adversely affect the environmental quality of coastal zones, or the resources that depend upon that quality, should be subject to prior environment assessments that will determine the impacts on the environmental and socioeconomic sectors. Such assessments should include mitigating measures and a requirement for subsequent monitoring to assess compliance and effectiveness.**

Continued

Box 3. (continued)

4. **Waste management strategies and measures should be guided by the following principles:**
   a. there should be no transfer of damage or hazards from one area to another, directly or indirectly, or transformation of such pollution into another type of pollution;
   b. a 'Precautionary Principle' should be applied to selected substances as a goal wherever feasible. This means the reduction of contaminant discharges, irrespective of the probable impacts on environmental quality, to account for the uncertainty of scientific knowledge of those impacts on coastal resources now or in the future;
   c. innovative processes for waste treatment and disposal that are applicable to the economic, sociocultural and physiographic characteristics of the region;
   d. effective participation of the private sector in the implementation of waste management programs through appropriate legislation, fiscal policy, resource use policy and incentives; and
   e. adoption of practices and encouragement of the use of technologies that minimize the use of space, raw materials, energy, and the generation of waste;

5. **The ASEAN nations should take all practical steps to prevent, control, reduce, or eliminate the discharge of substances to the coastal zone that cause harm to humans, marine life and other living resources, or that damage amenities associated with coastal environments. They should:**
   a. develop a "Black List" and a "Grey List" of polluting substances based on their persistence, toxicity or other noxious properties and their tendency to bioaccumulate. Measures should be taken to eliminate those substances on the "Black List" and to limit and reduce the discharge of those on the "Grey List";
   b. develop mechanisms in accordance with their legal systems for prompt and adequate compensation or relief, as well as rehabilitation, in respect of damage caused by pollution of coastal areas under their jurisdiction;
   c. introduce effective programs to recycle and reuse waste;
   d. promote the use of science and technology to develop cleaner technologies and innovative waste management strategies; to define the linkages between waste discharges and environmental impacts; and to assess the risks and uncertainties associated with waste management practices or the lack thereof;
   e. encourage education of the public, policymakers and the producers of waste, in the public and private sectors, about the opportunities for social and economic benefits to be derived from effective waste management strategies as well as the detrimental effects of inadequate or inappropriate management;

Continued

Box 3. (continued)

f. adopt programs that require polluters to bear the costs of pollution prevention, abatement and compensation; and
g. develop institutional arrangements that integrate waste management into development programs and projects.

6. **The participation of nongovernmental and community organizations should be encouraged in the development and implementation of waste management strategies in order to promote the wider participation of the public, especially women and children.**

7. **As part of a global responsibility for sustainable development, bilateral and multilateral funding agencies, including regional and international development banks, should develop more and vigorous technical assistance, financing programs and policies for waste management projects, including the integration of environmental concerns into development programs and projects, especially those that help protect the coastal living resources and the marine environment.**

Malaysian Development Plan. In the Philippines, the CAM plan was recently endorsed by the Regional Development Council in the pilot-site area, and a technical secretariat to spearhead plan implementation has been formed. In Thailand, the plan, combined with other CAM efforts in the country, has received Cabinet approval, and funding has been appropriated for implementation.

Irrespective of the sizeable and palpable national and regional impacts of CRMP, ASEAN has not been its exclusive beneficiary. While ASEAN members share many common aspects and face similar issues, there is a great deal of sociopolitical and economic diversity, and differing resource endowments within the region. These differences significantly influence the appropriate composition of, as well as the nature of the need for, integrated CZM efforts. The CRMP created an unprecedented real-life laboratory for exploration of the complexities and subtleties of integrated CZM planning under diverse conditions. As a result, there are many generalizable lessons in the rich experience of CRMP.

The lessons from CRMP are of three major types: (1) management process-related; (2) development stage-related; and (3) institutional setting-related (Box 4).

The **process-related lessons** are relevant to the planning phase of the management **process**. These involve the general need for the **essential mechanisms** of integration and coordination in both planning and implementation of management actions, as well as the **generally desirable characteristics** of the major steps in planning, and the **essential features** of CAM plans.

Box 4. Categories of lessons learned from ASEAN/US CRMP.

The lessons learned through the experience of CRMP are related to:

Process

- Desirable characteristics of the planning phase
  - iterative process
  - originate from within
  - integrated with development agendas
  - local participation
  - full consideration of existing institutional and organizational arrangements
  - research focused on identification of management priorities and opportunities
  - management actions matched with management issues and goals

- Essential features of management plans
  - situation profile
  - problems and opportunities
  - philosophy, goals and objectives
  - policies and strategies
  - programs and projects
  - organization and management
  - monitoring and evaluation
  - financial and economic justification

- Essential mechanisms
  - integration
  - coordination

Management Issues

- Traditional management issues
  - predominate in undiversified economies typically dependent on natural resource-based activities
  - associated with mix of activities typical of rural areas
  - critical issues tend to be related to the rate of resource exploitation
  - pollution issues usually of lesser importance

- Management issue transition
  - driven by economic diversification
  - function of the mix of development activities

- Modern management issues
  - predominate in more diversified economies
  - associated with mix of activities typical of urbanizing and urban areas

Continued

Box 4. (continued)

- critical issues tend to be related to pollution
- issues of overexploitation of natural resources usually of lesser importance

- Dualism and synergism
  - coexistence of traditional and modern management issues
  - traditional issues exacerbated by modern issues

Opportunities for Management Intervention

- Institutional and organizational arrangements
  - clarification, monitoring and enforcement of rights and obligations needed for most interventions

- Incentives and regulations to modify human behavior
  - work with the market when possible

- Direct public involvement and investment
  - financial constraints limit coverage
  - cost recovery should be pursued when possible

There is certainly no single correct way to organize, plan and implement a CAM program. The plan must be tailored to fit into the institutional and organizational[1] environments of the countries or regions involved, including political and administrative structures, cultural patterns and social traditions. Nevertheless, there are some generalizable features which encourage success.

Because of the multifaceted aspect of the coastal management issues and the multidisciplinary nature of the potential solutions, the traditional, disciplinary and sectoral planning and management approach has failed. It has become clear that effective management must embody two essential mechanisms: integration and coordination; that is, the planning process must be multidisciplinary and integrate all relevant issues. However, existing political and administrative realities make integrated implementation difficult, if not practically infeasible in some cases. Realistically, management actions will have to be implemented by various sectoral agencies. Therefore, coordination of these sectorally oriented agencies is essential to maintain the overall integrity of the management plan.

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[1]The convention of Gibbs (1986) is adopted throughout this paper to distinguish between the terms "institution" and "organization". "Institution" as used here refers to the *de jure* and *de facto* rules of a society which define rights (including property rights) and obligations of individuals and groups. In contrast, "organization" refers to orderings of people into entities such as community organizations, firms, NGOs and government agencies.

In addition, the management process must be organized and well structured to allow for periodic updating of the plan itself and adjustments to its implementation. The CRMP experience is drawn upon to illustrate the desirable characteristics of such a process, and the essential features of a good CAM plan.

The **development stage-related lessons** involve the likelihood of occurrence of specific management issues or problems created by transectoral effects of specific activities in coastal areas. The CRMP experience suggests a typology of coastal management issues which commonly occur with specific stages and levels of economic development, given resource endowments and the development directions being pursued in the planning area. This typology can be used as a heuristic tool to identify management issues likely to be encountered, given current stages of economic development, and to anticipate those likely to be manifested as economies diversify and evolve to be more complex. This typology allows planning to be more forward thinking, that is, proactive rather than reactive.

The **institutional setting-related lessons** focus on the opportunities for resolution of management issues. The choice of effective interventions is predicated on the existence of appropriate institutions and organizations. Again, the experience of CRMP suggests a typology which describes the influence of existing institutional and organizational arrangements on the right mix of management action elements. Initially, plans must be formulated in terms of an existing set of institutional and organizational arrangements. A major question is, however, the extent to which the existing arrangements provide adequate bases for management planning and implementation. Where these arrangements are found inadequate or constraining, the plan may propose changes. However, the reality that such arrangements are usually difficult to change in the short run restricts these adjustments. For practical purposes, management activities may have to be adapted to existing institutions and organizations initially, and desirable and feasible adjustments phased over the longer term.

This document distills and illustrates the CRMP experience. It first summarizes the process-related lessons. A discussion of the development stage-related lessons and the institutional setting-related lessons follows. Finally, implications for management and research are analyzed.

In its task, this paper draws on the work of many organizations and individuals, including the authors themselves, who participated in CRMP. Numerous project documents, including technical reports, workshop reports and proceedings, and the coastal profiles and integrated coastal management plans of the six countries were consulted. In addition, the discussions at the Regional Workshop on Coastal Zone Planning and Management in ASEAN: Lessons Learned were a major inspiration for the ideas and concepts developed in this paper.

However, this paper makes no attempt to be comprehensive or to completely document the CRMP experience. Rather, it seeks to identify and highlight the most significant lessons which may benefit future endeavors in CAM planning.

Accompanying papers in this volume provide more extensive and detailed documentation of the CRMP experience, as well as discussion of specific methods and tools for CAM.

Coastal Areas of the ASEAN Region

The ASEAN, with membership largely consisting of archipelagoes, islands and a peninsula, is in many ways an association of coastal nations. The region covers a land area of 3.1 million km^2 and, moreover, encompasses a vast expanse of ocean. Its member-countries, ranging in size from 1,000 km^2 (Singapore) to 1.9 million km^2 (Indonesia), together have more than 106,000 km of coastline. More than 60% of the region's population, estimated at 317 million in 1990, lives within close proximity to the coast (Fig. 1).

Population growth rates in ASEAN over the period 1980-1990 ranged from a relative low of 1.8%/year in Indonesia and Thailand to relative highs of 2.2, 2.4, 2.6 and 3.0%/year in Singapore, the Philippines, Malaysia and Brunei Darussalam, respectively. These rates of growth are expected to slow down considerably in 1989-2000; only Brunei Darussalam and Malaysia are projected to maintain relatively high rates over the same period. Nevertheless, the population of the ASEAN region is expected to increase by some 56 million people by the year 2000. If current population density patterns persist, the majority of this population increase, approximately 60% or about 34 million persons, will be in the coastal areas, increasing ASEAN's total coastal population to a projected 224 million by the year 2000.

Coastal areas of the ASEAN members are well endowed with economically important renewable and nonrenewable resources. In most of ASEAN, these resources directly support such activities as fisheries, forestry, agriculture, mining, tourism and ocean transport. In countries with more well-developed economies, these are, furthermore, important inputs into a host of industrial, manufacturing and service activities.

Nearly all stages of economic development, from developing to developed, find representation among the ASEAN members. The World Bank's classifications divide the region into low- (Indonesia and the Philippines), through lower middle- (Thailand and Malaysia) to high- (Brunei Darussalam and Singapore) income economies (Fig. 2).[2] In general, the low- and lower middle-income countries in ASEAN are natural resource-dependent. In these countries, the direct

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[2]Low- and middle-income countries are often referred to as developing economies. The classification adopted here follows The World Bank (1992), and is based on income corrected for differences in in-country buying power. This adjustment allows for more meaningful intercountry comparisons.

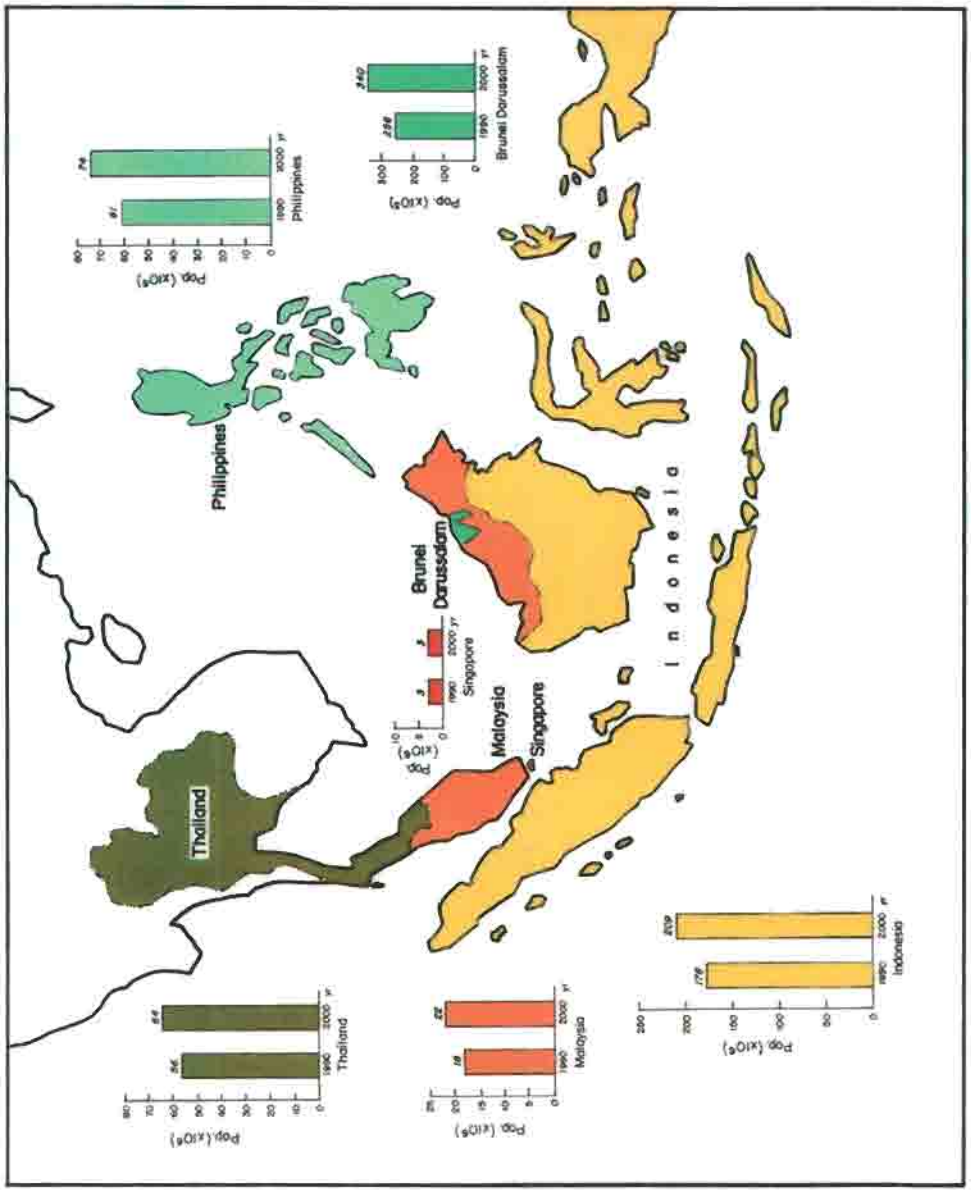

Fig. 1. Current and projected coastal population in the ASEAN region (WB 1992).

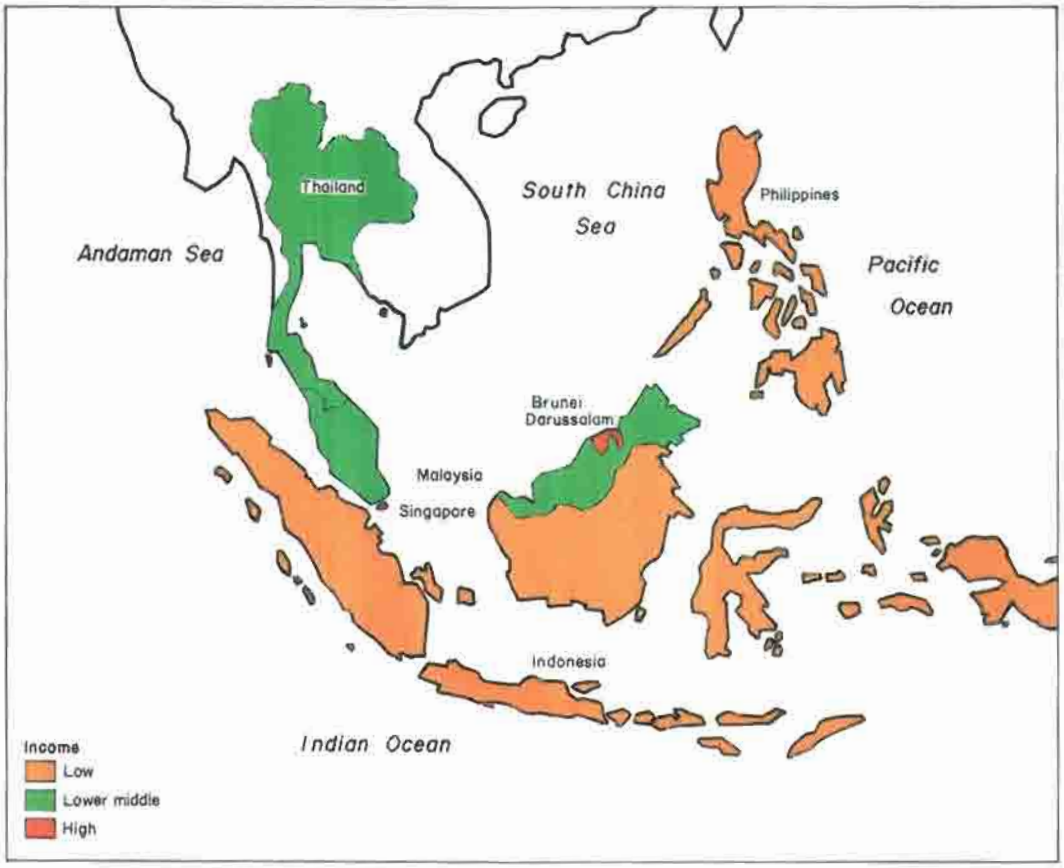

Fig. 2. Low-, lower middle- and high-income economies of ASEAN.

contributions to gross national product (GNP), export earnings and employment of coastal resources are quite significant. In addition, the lower middle-income economies, Thailand and Malaysia, have begun to diversify, but are still very natural resource-dependent.

There is an equally diverse sociocultural and political representation in the ASEAN region. The role of the region's governments in development is typically strong. For example, Singapore and Brunei Darussalam are highly centralized in power structure. While Brunei Darussalam provides generous and comprehensive social programs to Bruneians and the government is a major employer, Singapore is much more market-oriented in its policies and programs. Indonesia, Thailand and Malaysia are less centralized, but still command a top-down approach. In contrast, the current inclination in the Philippines is toward decentralization and devolution of power to regional and local levels.

A comparison of these and other important social, cultural and political characteristics of the ASEAN members–e.g., religion, ethnic mix and form of government–is given in Table 1. These aspects significantly influence, directly or indirectly, the likelihood of occurrence of management issues and the efficacy of possible management interventions.

Table 1. Social, cultural and political comparisons among ASEAN members.

	Brunei Darussalam	Indonesia	Malaysia	Philippines	Singapore	Thailand
Geography (Landform)	Part of island of Borneo	Archipelago	Peninsula/ archipelago	Archipelago	Island	Peninsula
Size (1,000 km²)	6	1,905	330	300	1	513
% Urban population	90	31	43	43	100	23
Population density (no./km²)	43	94	54	186	3,000	109
Dominant religion	Islam	Islam	Islam	Roman Catholicism	Buddhism	Buddhism
Major ethnic groups	Malay	Malay	Malay, Chinese, Indian	Malay, Chinese, Spanish	Chinese, Indian	Thai
% Adult literacy	NA[a] (medium)	77% (medium)	78% (medium)	90% (high)	98% (high)	93% (high)
Type of government	Malay Islamic Monarchy-Sultan	Republic-President	Monarchy-King/Prime Minister	Republic-President/ Congress	Republic-President/ Prime Minister	Monarchy-King/Prime Minister
Former colonizers	British	Dutch	British	Spanish, American	British	None
Role of central government in development	Dominant	Dominant	Dominant	Moderate	Dominant	Dominant

[a]NA - not available.

Coastal Areas and Sustainable Development

Geographically, coastal areas form the interface between land and sea, the complex physical and biological processes played out there testifying to the close terrestrial-aquatic links. Ecologically, coastal areas contain a number of critical terrestrial and aquatic habitats, which comprise unique coastal ecosystems, containing a valuable assortment of natural resources. These interrelated ecosystems are also closely linked with the socioeconomic systems to form resource systems

(Fig. 3). Resource systems can be conceptualized as encompassing the interactions among the biophysical, terrestrial and marine environments and human activities, including the governing institutional and organizational arrangements. The cross-hatched area in Fig. 3 represents the coastal zone, while the shaded area illustrates the coastal resource system.

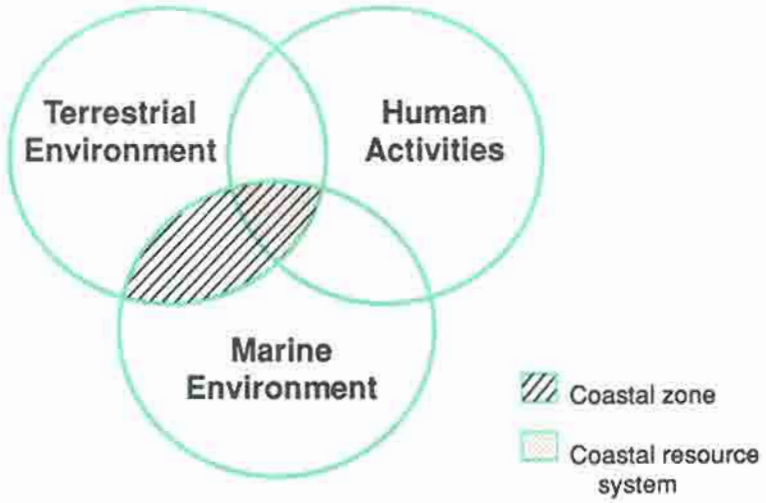

Fig. 3. Relationship between coastal zone and coastal resource system.

Coastal areas have long been focal points of human activity in the ASEAN region. Developing economies tend to be dominated by resource-based activities. Economic diversification, while increasing the complexity of economies and making the component sectors more interdependent, does not necessarily reduce significantly the dependence on natural resources, and can, in fact, increase both the occurrence and severity of natural resource and environmental conflicts.

As a result, natural resource and environmental concerns present a significant development challenge in coastal areas. Degrading and overexploitive uses of land, water and other coastal resources, and disruption of environmental processes through degradation of environmental quality and loss of critical terrestrial and aquatic habitats can lead to serious deleterious impacts on the health and productivity of coastal ecosystems, adversely affecting the food availability, health and economic welfare of coastal peoples.

Despite the potential for natural resource and environmental conflicts, the basic relationship between coastal development and the coastal environment is complementary. Development in many cases contributes to improved coastal

Box 5. Sustainable development.

Development of coastal areas and protecting the unique resources and environments contained there must be mutually supportive if development is to be sustainable. While the term "sustainable development" has provided a socially desirable goal, it has not given guidance for a unique course of action to attain the goal. We must still address what have always been the crucial factors relating to development: what to do, and how and when to do it.

In the development process, some tradeoffs are inevitable. Critical evaluation of tradeoffs is therefore essential to guide public policies. Using a critical comparison of benefits and costs embodied in the tradeoffs as a basis for developmental, environmental and natural resource policy is desirable. The results of this type of evaluation provide the best guidance for an appropriate course of action to lead to the goal of sustainable development.

Standard, sectoral-based development planning does not provide an appropriate forum for adequate identification and evaluation of benefits and costs. By virtue of its more comprehensive nature, integrated planning, such as coastal area management planning, takes into consideration all relevant issues and provides the necessary forum for the evaluation of benefits and costs. It thus furnishes the tools to draft blueprints for sustainable development—the integrated coastal zone management plans.

environmental management, which in turn is important for sustaining development in coastal areas (Box 5).

On the one hand, unmanaged economic growth, a commonly pursued path to development, often creates pollution, destroys natural habitats and encourages excessive depletion of natural resources. In such cases, development efforts are undermined because rising incomes from economic growth in these areas are offset by costs imposed by pollution on, for example, health and quality of life. Also, natural resource problems such as loss of critical habitat through irreversible conversion into other uses may reduce productivity of, and resulting economic benefits derived from, current coastal activities and limit potential for productive activities and benefits in the future.

On the other hand, many environmental problems, such as persistent excess effort and overinvestment in fisheries in much of the developing world, are the indirect result of lack of other opportunities--a condition caused by inadequate levels of economic development–coupled with open access. For example, many coastal fisheries contain no effective or enforceable barriers to entry, and are severely overfished. Despite the low incomes of many of the fishers, their extremely low opportunity costs resulting from lack of alternative employment significantly hinder their exit from the fishery. This creates dissipation of resource rents and serious and wasteful resource misallocation. Resource rent dissipation involves the loss of benefits which could be derived from unpriced inputs into the fisheries production process if they were used more efficiently.

Unpriced inputs include fish stocks and undegraded habitat, for which fishers don't have to pay to use.

The solution to this downward spiral is not to accelerate or decelerate the pace of development, or to increase or reduce its magnitude. Rather, it is necessary to develop differently, that is, in a word, sustainably. For development to be sustainable, it must meet multiple objectives--economic, social and environmental. In pursuit of sustainable development, available coastal resources and the coastal environment must be allocated and used efficiently and equitably among diverse uses, such as agriculture, aquaculture, tourism, industry and capture fisheries. Appropriate allocation of resources will require guidance and management interventions.

Significant implications for management are apparent. Intersectoral relationships among activities must be fully recognized and given due consideration in the choice of the economic activities to lead economic development and diversification in coastal areas; a more integrative approach is needed. Nevertheless, some tradeoffs are inevitable, and should be anticipated. Beneficial development may continue to entail some environmental losses, such as some degree of wetland draining and mangrove conversion, since to ban these completely would likely impose high opportunity costs. To minimize societal losses associated with these tradeoffs, a well-balanced management perspective is needed in which the benefits and costs of alternatives are critically compared, the appropriate management interventions known and made available, and the necessary institutional and organizational arrangements worked out and put in place.

Constructively, critical evaluation of tradeoffs requires that the positive and negative socioeconomic effects of coastal activities, including environmental effects, be assessed in the context of the prevailing national development objectives and the societal goal of sustainable development. Such an analysis should explicitly account for environmental costs in addition to the private benefits and costs attributable to the coastal activities. Even if development activities are privately beneficial, they should not be undertaken unless there are also positive net social benefits.

For most goods (e.g., fish) and services (e.g., tourism), prices are established in the market, and these prices represent their real value to society. However, for other goods (e.g., seagrass beds) and services (e.g., nursery or shoreline protection functions of mangroves) for which effective and enforceable property rights do not exist, accurate values are not set by the market due to **market failures**, or complete inhibition of market formation (Box 6). Whereas no markets typically exist for seagrass beds, land markets sometimes exist for mangrove areas. However, these markets fail to incorporate the values which accrue more broadly and therefore would be difficult for a purchaser of the mangrove area to capture.

Exacerbating market failures are **policy failures**, wherein government actions actually encourage activities which result in non-optimal resource use and environmental damage. For example, heavy subsidization of irrigation water tends to

Box 6. Market and policy failures.

The incentives and disincentives which individuals and firms face everyday significantly influence their normal behavior in all parts of life. Nowhere is this more obvious than in the conduct of economic activities.

Economic incentives can originate in the market or in government policies. Incentives which originate in the market are in the form of market prices, which guide the interactions of producers and consumers. For example, an increase in the real market price of shrimp signals that more shrimp is demanded, and induces more individuals or firms to produce shrimp, either through capture or culture.

Alternatively, incentives can originate in government policies, and many times are also reflected in the market through changes in the relative prices of goods. For example, when governments subsidize the technological development of less polluting industrial processes, they intentionally reduce the costs of production of such a technology, and thus the minimum price at which it would be supplied in the market, in the hope of creating incentives which encourage advancement in this field.

While incentives—whether originating in markets or policies—often do well in guiding private behavior in socially desirable directions, sometimes these incentives have unintended side effects or cause behavior which may be inappropriate from a societal perspective. Such cases are referred to as market or policy failures.

On one hand, government policies can cause perverse results. For example, the policy of many governments to transfer fishing rights from large- to small-scale fishers is typically made, based on equity arguments, to help to raise the income of small-scale fishers. However, the policies have ignored the reality that access to fisheries, particularly small-scale ones, is uncontrolled. As a result, although the commercial subsector could be excluded from certain fishing grounds, total fishing effort in these areas cannot be restricted currently. These policies have had the unintended result to draw more fishers into the small-scale sector, and exacerbate problems of overfishing and use of destructive fishing practices.

In contrast, market failure is the inability of market prices to reflect accurately the value of a good or service. The inability of land market prices to reflect the full social value of mangrove areas is a good illustration of market failure. When markets function well, market prices of land reflect the value of the land in its best use, that is, the use that would bring the highest return. For example, prime agricultural land on average sells at a price equal to the discounted value of the returns to the land, if used for agriculture over the long run. In these cases, private buyers and sellers have secure property rights over the land and the benefits it generates. Furthermore, the costs of transactions between these buyers and sellers are minimal. Therefore, these buyers and sellers will interact in the market to exchange land, and the market price thus set will be reflective of the value of the land.

Continued

Box 6. (continued)

Conversely, the value of many goods and services which are produced in mangrove areas are not captured in land market transactions. For example, many of the products collected in mangrove areas, such as fuel wood, timber, fish and tannin, are not marketed, but rather are used by those who collect these products. Additionally, benefits from the ecological and shoreline protection services provided by mangroves accrue to a large and widely dispersed group. Because the property rights to these goods and services are ill-defined, and because the costs of transactions between the owners of the mangroves and the beneficiaries of these goods and services are high, their value cannot be captured by the owners of the mangroves. As a result, the value of these nonmarketed goods and services will not be considered by private buyers and sellers who interact to exchange mangrove areas, and thus set their market price.

Unfortunately, even when mangrove areas are considered public lands, decisions to convert these areas to other uses often do not consider the value of the nonmarketed goods and ecological services which will be lost as a result of the conversion.

encourage inefficient water use in irrigated agriculture, and often leads to excessive withdrawals from surface waters and underground aquifers. Severe environmental impacts can result, such as land subsidence and change in salinity patterns in estuarine habitats.

In the absence of effective property rights and their enforcement, markets often fail. This failure results in externalities or spillover effects, wherein some benefits or costs associated with a production or consumption activity are external to the one undertaking it. Consequently, the person producing the externality will not take into account its effect on others. In the case of a negative externality, the full costs of the activity are not considered in decisions and it is continued beyond the socially desirable level.

Both market and policy failures abound in coastal areas, and government interventions are the key to ensure that these failures are corrected and resource scarcity is reflected in resource-use decisions. A common prescription is to correct the distortion caused by policy and market failures through a variety of government interventions including changes in property rights and other institutions governing resource use; policy instruments such as market-based incentives and regulatory measures; and direct public investments. The most effective interventions are those which focus directly on specific issues; use a flexible combination of regulations; incentives and direct investments; and recognize institutional and organizational constraints.

For example, to address the specific issue of loss of coral reef habitat, a combination of several management actions can be taken. Rights governing the use of

specific coral areas can be clarified by establishing territorial use rights in fisheries (TURF) for the local communities. In addition, destructive fishing methods, such as blast fishing and muro-ami, as well as coral extraction can be directly regulated. For this to be effective, the regulating agencies' monitoring and enforcement capabilities may need to be strengthened, and the local communities may need to become more involved. A market-based disincentive can be used through the imposition of taxes on coral products. Finally, the public can become directly involved through public investment in natural reef-seeding programs, the placement of artificial reefs, and the establishment and management of marine parks and protected areas.

Guidance for appropriate government intervention is best achieved through a multifaceted, integrated approach that addresses the key factors—biotechnical, economic, and institutional—that influence progress toward sustainable development. Integrated CZM planning is an attempt to meet this challenge through the identification of relationships, both diagnostically and prescriptively, between and among these relevant factors.

Integrated Management

The purpose of integrated management is to allow multisectoral development to progress with the fewest unintended setbacks and the least possible imposition of long-run social costs. In contrast to a sectoral development plan, the focus of an integrated management plan is on mitigating measures to reduce social costs associated with sectoral activities accruing both inside and outside the sector in question. To be effective, management plans should be integrated with development plans, and implemented in a coordinated fashion.

CAM employs an integrated, multisectoral, strategic approach for the efficient allocation of scarce resources among competing uses, and minimizing unintended natural resource and environmental effects. The policy options and management strategies formulated within this framework are well founded on information on the natural function of ecosystems, the assimilative capability of the environment, the motivations of and incentives faced by people using the resources, the economic setting, and the ways and means to bring private behavior in line with social goals.

In this sense, CAM must be viewed as a **system** with three mutually supporting **dimensions**, graphically represented as a cube in Fig. 4. The dimensions of the cube are: (1) management **process**; (2) identified management **issues**; and (3) management **actions**. The cube is actually made up of a number of blocks fitted together. The base of the cube is formed by the planning blocks, which have both management issue and management action dimensions. The next layer of the management system cube is formed by the implementation blocks, and the final layer by the monitoring and evaluation (M&E) blocks, both of which also have

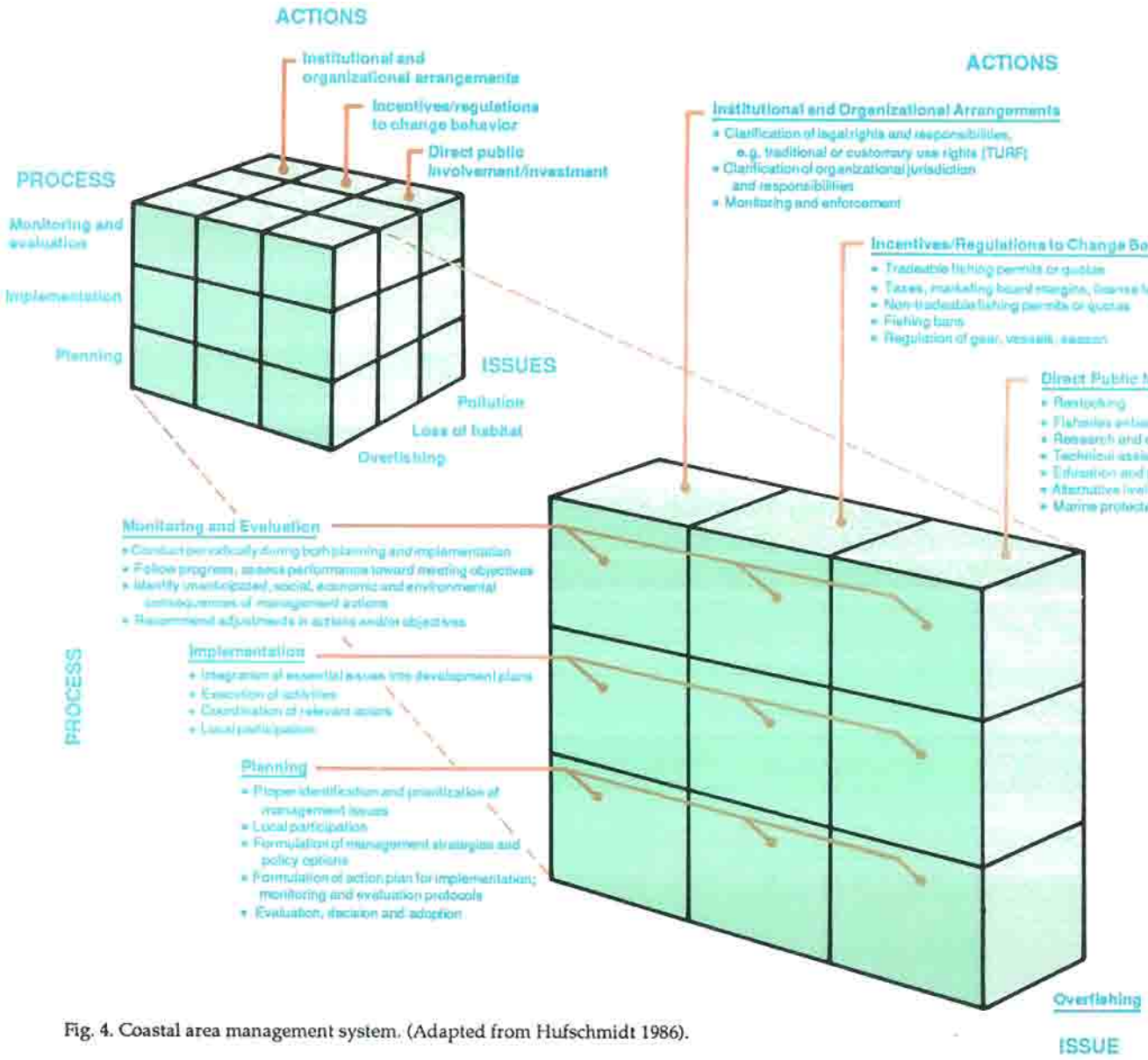

Fig. 4. Coastal area management system. (Adapted from Hufschmidt 1986).

management issue and action dimensions. All three dimensions of the management system are essential. If any of the dimensions is ignored, the system will eventually collapse or be rendered ineffective. The enlarged boxes in Fig. 4 illustrate the planning process and management actions related to a particular management issue, overfishing.

The management **process** is iterative and involves three main steps--**planning, implementation** and **M&E**. For ease of illustration, these steps can be viewed as sequential, but in reality they are often overlapping (Fig. 5).

The **process** is oriented toward identification and resolution of the management **issues**. In the context of CAM, these could include problems such as pollution, habitat degradation, nonoptimal resource exploitation, shoreline erosion and other resource-use conflicts.

The management issues are often grouped into general categories to be addressed by specific management action plans, such as water quality and habitat protection. These action plans are actually made up of a bundle of management **actions**, each of which addresses specific parts of the management issues. The general categories of management actions are **direct public involvements** or investments; interventions directed at the modification of human behavior, including policy instruments such as **regulations** and market-based **incentives**; and the **institutional and organizational arrangements** needed to facilitate the accomplishment of the management activities (Table 2).

All three management system dimensions--process, issues and actions--will be discussed in more detail and illustrated by examples from ASEAN/US CRMP in the next section.

ASEAN/US CRMP

Plan for planning

The planning process begins with an inception stage during which the geographic and temporal scopes of the plan are determined, planning objectives and evaluation criteria are defined, and a workplan elaborating the conditions for and approach to the studies and analyses is adopted. Under CRMP, guidance for this step was provided by ICLARM's CAMP in consultation with project and national steering committees.[3]

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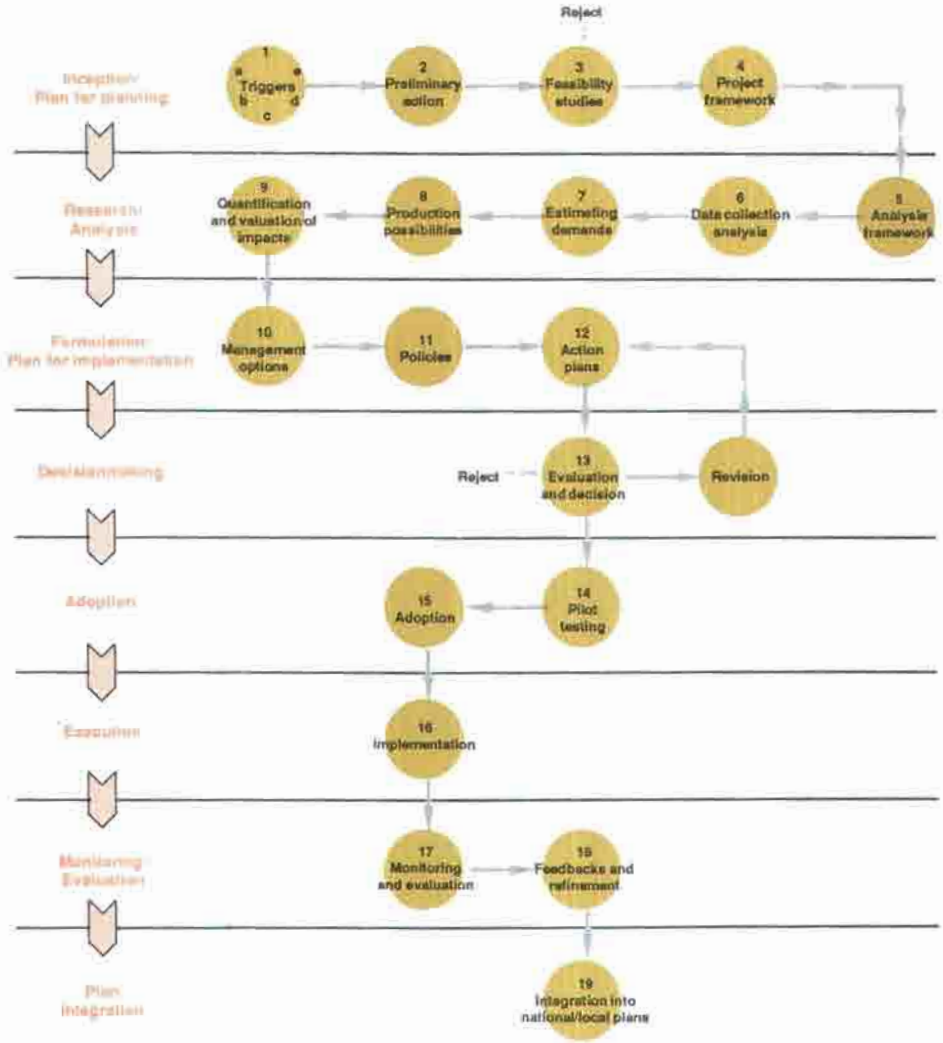
[3]The Project Steering Committee (PSC), comprised of representatives from the six participating countries, was responsible for providing project direction and establishing general operating procedures. In contrast, a National Steering Committee (NSC) established in each of the participating countries, consisted of representatives of the agencies and organizations involved in CRMP. The NSC was responsible for providing in-country direction and operating procedures.



1. Triggers of process by one or combination of factors: a. resource depletion; b. pollution; c. environment incident; d. concern for sustainable development, e. other factors.
2. Preliminary action: awareness of coastal issues and initiation of formal process.
3. Feasibility study: preliminary assessment of coastal issues, management needs.
4. Setting up the project framework: project formulation, determining coordinating institution, project document, work plan.
5. Setting up the analysis framework: coastal profile, goals/objectives, targets, time frame, boundaries, approaches/scenarios, criteria for evaluation/monitoring, legal/institutional framework.
6. Carrying out analysis: issues, causes, impacts, constraints.
7. Estimating demands for products/services: types of products and services generated; demand level.
8. Analyzing production possibilities: output estimate, strategies, attainments.
9. Quantification and valuation of impacts: present and future economic activities, ecological risks, sensitive areas.
10. Management options: conflict resolution, impacts.
11. Policy formulation: general and specific policies based on management options selected.
12. Action plans: finalizing specific activity with budget, manpower, institution involved; implementation strategies.
13. Evaluation and decisionmaking: management strategies by decisionmaking bodies, acceptance or rejection of proposal.
14. Pilot testing: pilot site selection, plan implementation, refinement.
15. Program adoption: acceptance for full implementation.
16. Implementation: implementing institution to carry out action.
17. Monitoring/evaluation: assessing attainment of objectives and impacts.
18. Feedbacks and refinement: setting up feedback mechanism, refinement needed.
19. Integration: integrating CAM into national/local government development plans.

Fig. 5. Coastal area management process (Chua 1989).

Table 2. A typology of management system actions for selected management issues.

Issue	Category	Direct	Indirect
Pollution	MBI	Effluent charges; tradable permits; deposit-refund system	Subsidies or taxes on inputs or outputs; subsidies for use of substitutes and abatement inputs; performance bond
	CAC	Regulation of emissions; emission standards	Regulation of equipment, processes, inputs and outputs; technical standards; efficiency standards for inputs or processes; bans and quotas on inputs or outputs; land-use zoning
	DGI	Waste collection, treatment and disposal	Research and development; education; technical assistance
	IOA	Legal rights and obligations; organizational jurisdiction and responsibilities; monitoring; enforcement	
Nonoptimal resource exploitation	MBI	Tradable fishing permits or quotas; stumpage fees	Taxes; marketing board margins; license fees; concession lease fees
	CAC	Nontradable fishing permits or quotas; logging quotas or bans	Regulation of gear, vessels, season
	DGI	Restocking; fisheries enhancement	Research and development; education; technical assistance
	IOA	Clarification of legal rights and responsibilities, e.g., TURFS, traditional or customary use rights; clarification of organizational jurisdiction and responsibilities; monitoring; enforcement	

Continued

Establishment of Planning Goals and Objectives. The goals and objectives of CAM are influenced significantly by local, regional and national development agenda. Nevertheless, CAM should be envisioned as a way of integrating a blueprint for sustainable development into traditional economic development planning and management. This is done through promoting integration of sectoral policies, investment strategies and management arrangements to facilitate conditions under which coastal activities, including capture fisheries and aquaculture, can best contribute to sustainable development and the welfare of coastal communities.

The goal of sustainable development embodies multiple objectives–economic, social, environmental–and relies heavily on appropriate institutions and policies to help guide resource use. The CAM plans provide concrete courses of action,

Table 2 (continued)

Issue	Category	Direct	Indirect
Habitat degradation	MBI		Taxes on coral products; subsidies on alternative fuels to charcoal and wood
	CAC	Regulation of mangrove conversion, coral harvesting	Land-use zoning; regulation of blastfishing, muro-ami, inshore trawling, boat anchorage, SCUBA diving; regulation of coral products; regulation of dynamite
	DGI	Parks and protected areas; reef seeding; artificial reefs; mangrove replanting	Research and development; technical assistance education
	IOA	Clarification of legal rights and responsibilities e.g., TURFS, traditional or customary use rights; clarification of organizational jurisdiction and responsibilities; monitoring; enforcement	

CAC - command-and-control regulations
DGI - direct government involvement or investment
IOA - institutional and organizational arrangements
MBI - market-based incentives
Adapted from Eskeland and Jimenez (1991).

which when incorporated into national development plans provide appropriate management actions to help move toward the goal of sustainable development. A prerequisite for this, however, is the acceptance of the management plan by the government and its support by the stakeholders in coastal areas.

Composition of Planning Team. To meet the broad mandate laid out in the goals and objectives, the CAM team should be composed of the right mix of experts who have experience in the integrated management of coastal areas.

It is important that the plan is largely developed by locals rather than expatriates; the prospects for implementation are much better if locals consider the plan as their own and not one that is forced on them by outsiders. One must recognize, however, that there is a scarcity of expertise in CAM in developing countries. Therefore, it may not always be possible to obtain the services of local experts with broad-based training and experience in resource planning and management. The next best option is for a multidisciplinary team to be formed to undertake the job.

Table 3 presents the ideal composition of a multidisciplinary team for CAM. The core experts should together provide a broad perspective. The combination of their disciplines, which range from sociology, economics and institutions, to

Table 3. Suggested core and support experts needed for CAM planning.

Core expert	Main responsibility
1. Coastal zone planner	team leader; provides planning direction; general land and water uses; institutional and organizational arrangements
2. Resource economist	macroeconomic policies and their implications; economic valuation; benefit-cost analysis of management options
3. Ecologist	resource assessment analysis of ecological impacts and potential changes
4. Sociologist	social and cultural issues; community consultation and participation
5. Environmental engineer	technical and physical interventions; carrying capacity of coastal areas
Support expert	**Specific concern**
6. Parks/tourism specialist	tourism-related issues, including marine parks and nature reserves
7. Pollution expert	environmental impacts; waste management
8. Fishery expert	fishery resource assessment; harvesting and utilization
9. Aquaculture expert	farming system; aquaculture planning and management
10. Forestry expert	coastal forest planning and management

ecology and engineering, is adequate for a comprehensive management view. In some cases, technical backstopping may be required from a broader group of disciplines.

Ideally, the leader of the planning team should be a professional planner, who can provide the overall planning direction. The coastal planner should focus on general land- and water-use issues, and the institutional and organizational arrangements governing coastal activities, as well as those for activities outside the coastal area which have coastal impacts.

The resource economist should concentrate on identifying policy and market failures; estimating current and future demands for coastal resources; and placing monetary values on natural resource and environmental impacts. Furthermore, the economist should conduct benefit-cost analyses of management

options, and identify opportunities for the use of market-based incentives and regulations.

The ecologist's work should have two main thrusts. First, the focus should be on the definition of the carrying capacity of the coastal area. Second, the ecologist should identify and quantify the current and potential impacts of human activities on coastal areas.

The sociologist should closely examine social and cultural issues, and be the point person to encourage community consultation and participation in the planning process. Finally, the environmental engineer should work with the ecologist to define the carrying capacity of the coastal area. Furthermore, the engineer should identify opportunities for physical and technical interventions.

An essential ingredient to successful CAM is the employment of appropriate leadership both at the planning and implementation stages. Of course, CAM must be steered by people who are technically knowledgeable. More importantly, perhaps, the CAM leadership must be able to coordinate the work of scientists and organizations, which may have conflicting interests and disciplinary biases.

A full-time coordinator as well as a team of full-time CAM staff is crucial to ensure effective and timely execution of CAM. One problem encountered by CRMP was that the national project directors or national coordinators were not assigned full time to the project. Because of their part-time involvement, some critical project activities were hampered particularly when immediate actions were required.

The quality of the coordinator is essential. Strong interpersonal and organizational skills are vital, apart from technical competence in CAM. One of the coordinator's main functions is to bring various agencies to work together and maintain close links with concerned officials at different levels of the government. Hence, trust and confidence in the coordinator is of utmost importance.

Pilot Site Selection. One of the initial tasks under Component 1 of CRMP was to select a pilot site in each of the ASEAN members. For large countries with no experience in integrated CZM, it is a formidable task to develop a national program. It is therefore advisable initially to select a pilot site of a manageable size within the existing legal and institutional framework, which can eventually serve as a working model for other parts of the region or nation. The working model can be duplicated in other parts of the country and a national coastal policy can be developed.

The six pilot sites selected for CRMP are (1) Brunei Darussalam - entire coast and estuarine system; (2) Indonesia - Segara Anakan; (3) Malaysia - South Johore; (4) Philippines - Lingayen Gulf; (5) Thailand - Phangnga Bay and Ban Don Bay; and (6) Singapore - entire island (Fig. 6).

Definition of Boundaries. Ideally for management purposes, the boundaries of a coastal area should be defined by the extent of the area of relevant interaction, including biophysical, economic and other social factors. Islands or small

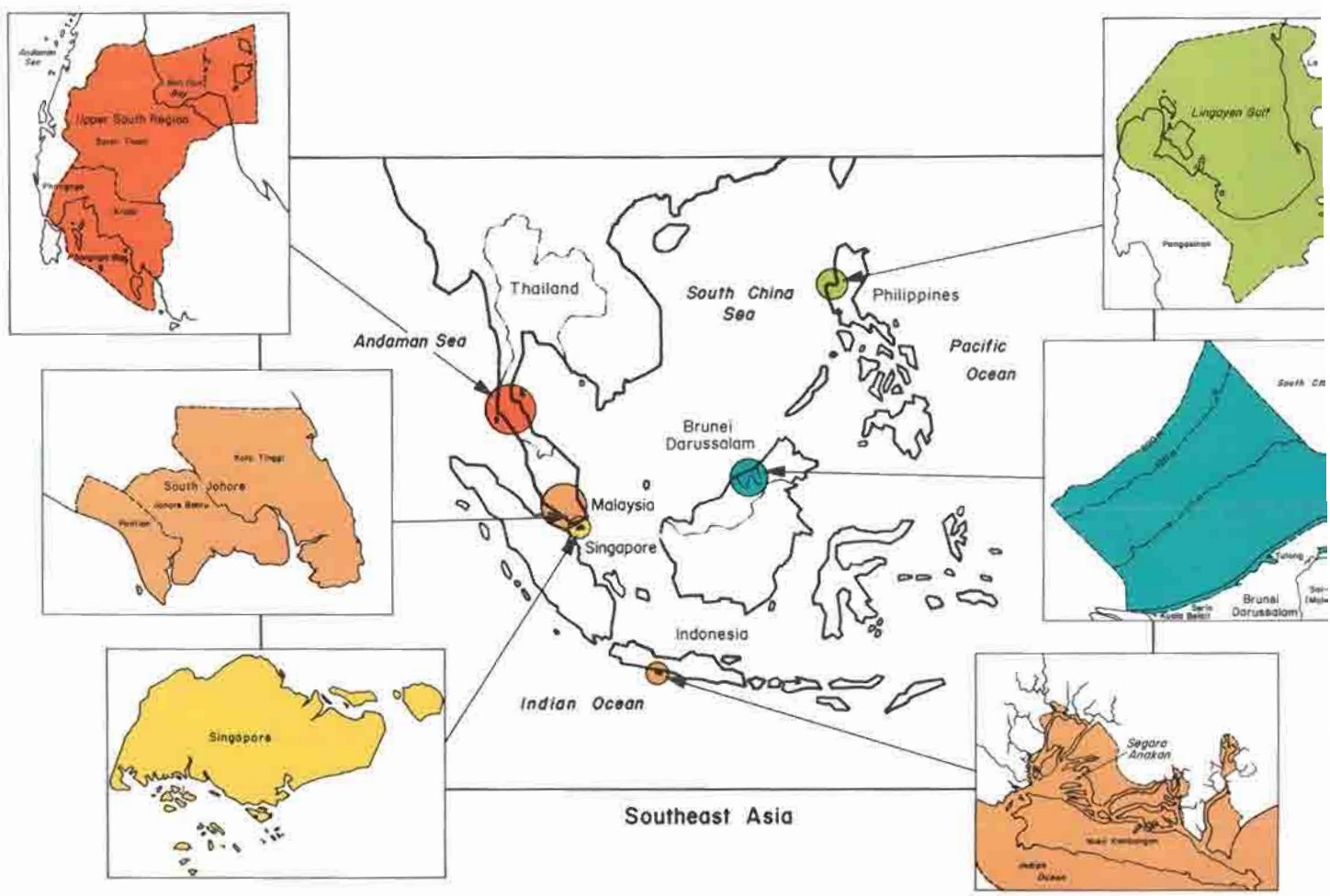


Fig. 6. The six pilot sites in the ASEAN region selected for CRMP.

nations, such as Singapore and Brunei Darussalam, can be practically managed in their entirety. Unfortunately, for most other countries, the scale puts a practical limit on the extent of a manageable area. In these cases, there is rarely a clearly defined physical boundary, either landward or seaward, which incorporates all the relevant factors (Fig. 7).

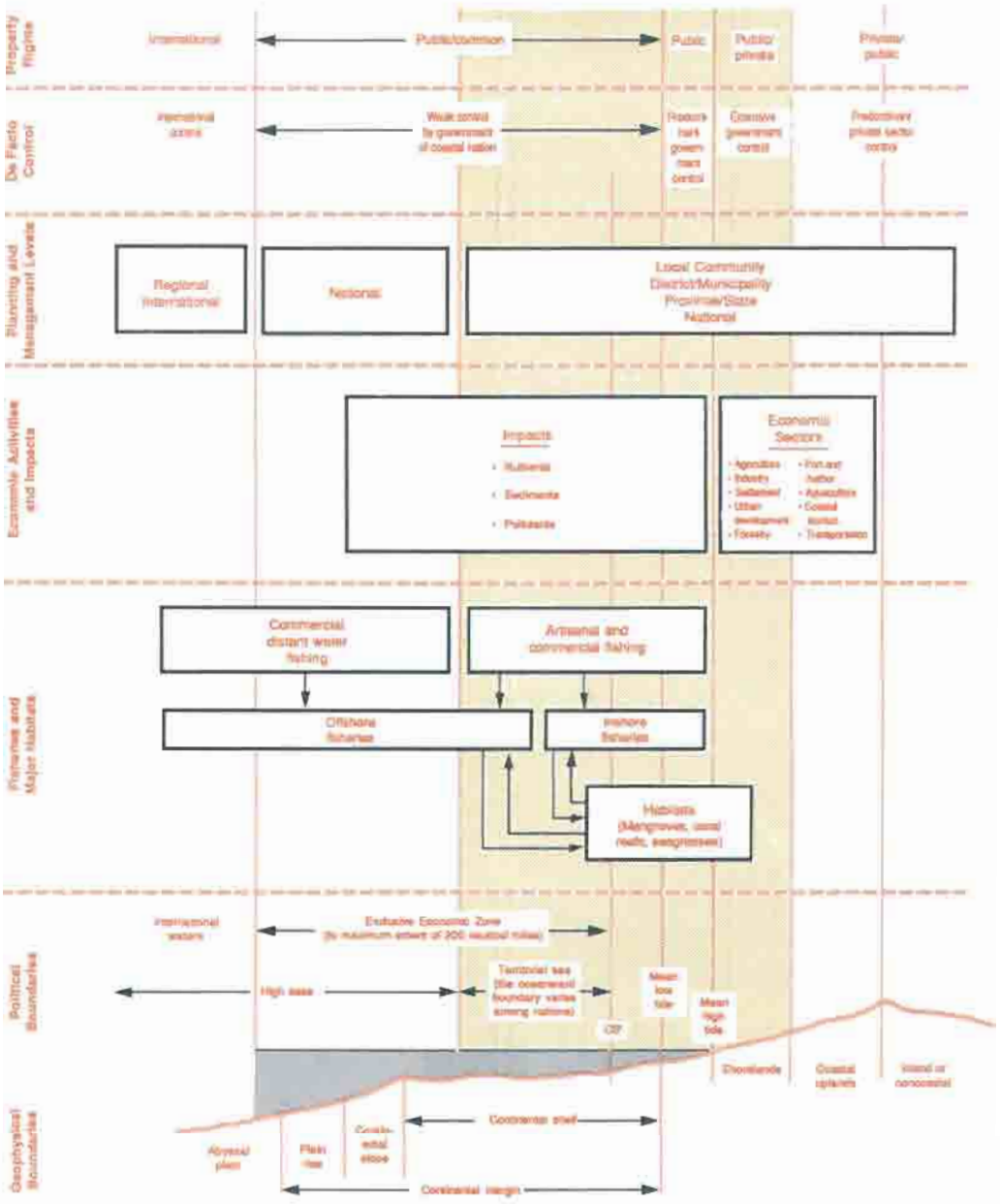
As a result, coastal area boundaries typically are defined by use of proxy boundaries. For example, (1) prominent physical landmarks or other physical criteria; (2) political boundaries; (3) administrative boundaries; (4) arbitrary distances; or (5) selected environmental units are often used. These proxies can be used either individually or in combination, as they were in CRMP (Table 4). In addition, each has advantages and disadvantages for use as a coastal area boundary.

Physical criteria are often used to delimit the seaward boundary of a coastal area. For example, in Segara Anakan, the seaward extent of the planning area is from the shore to the 200-m isobath. Alternatively, the edge of the continental platform or shelf may serve as the seaward boundary, as in the case of the pilot sites in Thailand. In either case, a local survey is required to delineate the exact boundary location. In the landward direction, the boundaries could also be based on physical criteria, as in Lingayen Gulf, where five noncoastal municipalities with brackishwater fishponds are included in the planning area. While the use of physical criteria may be practical for the short term, it may prove unreliable in the long run due to the transitory nature of some physical landmarks.

Administrative boundaries relate to existing subdivisions such as municipal or provincial borders, as in the case of the landward limit of the Lingayen Gulf pilot site. Similarly, political boundaries, such as the territorial waters, were used as the seaward limit for Singapore's management area. These types of boundaries have the advantages of being easily understood, readily representable and legislatively viable. In some cases, such as that in Lingayen Gulf, it may be necessary to use administrative boundaries to ensure plan implementation. However, these types of boundaries have the limitation of rarely coinciding with biophysical phenomenon and therefore do not necessarily encompass all relevant interactions.

Arbitrary distances can be used to set boundaries for both landward and seaward directions. In CRMP, arbitrary distances are used for the landward boundary of the Brunei Darussalam coastal management area, and the seaward boundary of the coastal management area in South Johore. While boundaries that are set using arbitrary distances are easily defined, they may bear no relationship to the area containing the relevant interactions.

Coastal management areas may also be defined using selected environmental units. For example, part of the definition of the landward boundary of the management areas in Brunei Darussalam and Indonesia included tidally influenced rivers, streams and other areas. This type of boundary delineation has sound ecological and scientific basis. In other cases, the relevant watershed or river



CB* - The coastal baseline is a series of straight lines that interconnect coastal headlands and promontories; it is the reference point used to map the oceanward boundary of both the territorial sea and the exclusive economic zone.

Fig. 7. Overlapping biophysical, economic, institutional and organizational boundaries in coastal areas (Modified from Sorensen and McCreary 1990; Elder and Pernetta 1991).

Table 4. Definition of coastal area boundaries under ASEAN/US CRMP.

Country	Landward boundary		Seaward boundary	
	Description	Type	Description	Type
Brunei Darussalam	All land and water areas 1 km inland from MHWST and areas inundated by tides any time of the year	AD/SEU	From MHWST level of the shore to 200-m isobath	PL/C
Indonesia	Municipal boundary of Cilacap (east), border between Cilacap and Ciamis districts (west), north point where there is no tidal influence on rivers and streams	AB, SEU	From shore up to 60-m isobath (south)	PL/C
Malaysia	District boundaries of Pontian, Johore Bahru and Kota Tinggi	AB	Up to 20 km from the shore to include some islets in East Johore (Mersing district)	AD, PL/C
Philippines	Boundaries of 17 coastal municipalities along Lingayen Gulf and 5 noncoastal municipalities with brackishwater fishponds	AB, PL/C	100-fathom isobath with straight lines connecting the 2 coastal municipal boundaries—Bolinao and San Fernando	PL/C
Singapore	Whole island of Singapore	PB	Territorial waters and offshore islands	PB
Thailand	Boundaries of all coastal districts of Phangnga and Ban Don bays, Upper South	AB	Shoreline of Ban Don and Phangnga bays into shallow continental shelf to include major islands within	PL/C

AB - administrative boundaries
AD - arbitrary distance
MHWST - mean high water at spring tide
PB - political boundaries
PL/C - physical landmark/criteria
SEU - selected environmental units

basin may serve as the landward boundary. Notwithstanding, environmental units are not easily understood and may require specialized surveys for precise definition.

A general rule for choice of planning area boundaries is, when administratively and politically feasible, the planning area should be coterminus with the area which includes all relevant interactions. Where this is not feasible, planning should at least take into account the linkages--biophysical, economic and social--with the outside.

Research

Profile Preparation. The success of the integrated CAM approach rests on the availability of baseline information and the understanding of the relationships among key factors in order to properly identify and prioritize management issues.

Baseline data gathering provides information on the coastal resource systems of the study area. This includes biophysical, sociocultural, economic, institutional and organizational data. Also included in this category are sectoral indicators such as optimum yield or target production rates used to make projections of the area's development trajectory.

For most coastal sites, there is a wealth of secondary information. In many instances, however, the information has not been fully analyzed or is scattered in unpublished reports. The first task in identifying and prioritizing management issues is to compile and synthesize into a readily usable form--a so-called coastal profile--all secondary information on the biophysical aspects of the area; socioeconomic features characterizing the nature and significance of resource-dependent activities in the area; and existing legal and institutional provisions for management of the site for which the management plan is to be prepared.

Resource planners and managers from relevant government agencies, concerned NGOs, and community representatives are invaluable sources of information. These sources should be tapped with respect to the identification of management issues, determination of causes, suggestion of management options, and identification of information gaps on which subsequent research will be focused.

The information collected is then analyzed to determine trends and relationships among key elements in the study area. In addition, impact assessment will generate information on the interactions of sectoral development activities with the environment. Both positive and negative impacts on the environment, as well as conflicts within and among sectoral activities can then be identified.

For CRMP, secondary information from diverse sources, ranging from annual reports to departmental documents, have been used in profile preparation. Many of these are largely unpublished, classified or restricted and were made available

through multiagency involvement. Also, national workshops were organized to secure additional relevant and updated information about the pilot site, particularly on resource-use conflicts and management. Such workshops involved the participation of the project staff, resource managers, and community and government representatives to identify management issues, determine their causes, provide management options, and identify information gaps on which subsequent research was focused.

Additional Studies. Where data gaps exist, primary data must be collected. Also, updating and/or verification is necessary to ensure reliability and viability of information required for decisionmaking.

In CRMP, the coastal environmental profiles and the national workshops provided the basis for the establishment of the research programs in each of the participating countries. Under the programs, multidisciplinary teams conducted research relevant to biological, physical and environmental aspects of the site; socioeconomic conditions; existing institutional governance of resource use; and organizational responsibility in resource management. The information needs for CAM are outlined in more detail in Box 7.

Box 7. Information needs for CAM.

Biophysical and Environmental Aspects

- Resource inventories
- Determination of environmental linkages and processes
- Identification, monitoring and evaluation of environmental change
- Physical quantification of environmental impacts

Social and Economic Aspects

- Social, cultural and economic characterization of coastal communities
- Estimation of demand and supply of coastal resources, and projection of future demand and supply
- Identification of current and potential future resource conflicts
- Identification of market and policy failures
- Economic valuation of coastal resources including nonmarket valuation
- Evaluation of alternative policy options and management strategies

Institutional and Organizational Aspects

- *Rights and obligations with regard to coastal resource use*
- Organizational jurisdiction, responsibilities, structure and coordination

Opportunities for Management Interventions

- Evaluation of opportunities for and efficacy of interventions to influence behavior
- Evaluation of opportunities for and efficacy of direct public involvement or investment

In particular, information is needed on estimates of the availability and quality of water and related coastal land resources; estimates and projections of coastal activities, associated coastal resource demands, and problems and impacts; and identification of the need and opportunities for government intervention.

Methods and Procedures. *Conventional methods vs. rapid appraisal of coastal environments (RACE)*. Rapid appraisal may provide a fast-track procedure for analyzing the socioeconomic and environmental conditions of a given coastal area. Rapid appraisal techniques utilize many research tools similar to those employed in conventional research. However, to speed the analysis, the focus of the appraisal is on a narrower set of characteristics or key indicators. The RACE approach is described in detail in a separate paper in this volume.

Community participation, consultation and involvement. Strong roles for local communities have been advocated for all forms of resource management, conservation and environmental protection. Advocates of this concept stress the importance of the involvement of community members in planning and managing the resources. The term community in this context is used synonymously with stakeholder--people who use and are dependent upon the resources in question.

A variety of possible roles could be played by communities in planning and management. Community consultation is the least involved; it is used merely to solicit preferences and attitudes. Alternatively, communities can be invited by the government to participate more substantively at various stages of the management process. However, in both these cases, control remains with the government.

While there is a growing awareness that real public participation often results in a more comprehensive, efficient and successful planning, it does not guarantee that all who get involved will be benefited. As Whitehead (1976) points out: "No single policy or proposal can equally advantage all the sectors and factions that make up the community; indeed what benefits one group can, and will, disadvantage others."

Considering the multiple resource-use characteristic of the resource system, all parties who have a stake should be consulted and preferably asked to participate in the planning for and management of coastal areas.

In contrast to community participation or consultation, community involvement (sometimes referred to as community-based management) is a somewhat different concept and may be more difficult to apply. Community involvement implies full and continuous participation in the management process from the beginning.

Successful community-based management has several prerequisites. First, communities must be empowered with rights and obligations; that is, there must be a legislative framework in which rights to a certain resource are allocated to a specific group of individuals in the community, and the obligations to manage these resources must also be clarified. To achieve this, legislative reform usually

is necessary in most countries. Second, government organizations are still required to provide the community with and enforce appropriate management measures, including institutional and technical support, regulations and economic incentives. Third, communities need to develop the necessary skills and disciplines to organize and manage themselves to adopt sound management principles, rules and regulations. It must be stressed that the acquisition of such organizational and technical skills requires time. While some groups have traditional and customary management regimes, these are uncommon.

In Southeast Asia, community participation and/or public consultation are more generally acceptable to all sectors in CAM planning than community-based management. Although less rigorous than community participation, community consultation, if properly implemented, is a step in the right direction.

Community-based management is effective in a political climate that recognizes the right of a specific group to common property resources and when the group as a whole is ready, that is, has the organizational capabilities to take the lead role in management.

Remote sensing and geographic information systems (GIS). When used in combination, remote sensing and GIS are powerful tools for CAM. Remote sensing employs satellites to acquire information on the assessment of resources and human activities. This information provides a base for extrapolation and interpolation of field data gathered through traditional survey methods. However, these data are sometimes not readily accessible because they are considered highly classified in some countries, and are often rather expensive.

GIS are computer systems that can be used for storage, retrieval, analysis and display of geographically referenced information. These methods can be effectively used in combination to establish zonation schemes which consider coastal processes, land and water uses and environmental impacts of human activities. These tools are reviewed in more detail in Kam et al. (this vol.).

Economic valuation. Pollution of coastal waters and loss or degradation of critical habitats such as coral reefs and mangroves can impose real costs on societies. These costs are manifested in several forms: economic losses resulting from reduced productivity of resource-based activities and loss of biodiversity; medical expenses, loss of earnings, and human suffering caused by impairment of health; and reduced aesthetic appeal of coastal areas.

The costs of coastal environmental and natural resource problems are often not adequately reflected by markets. In fact, the existence of these issues can be traced to market failures and pervasive externalities. While escaping these costs would confer benefits on society, these problems persist due to the inadequacy of public intervention.

Evaluation of the appropriate role of governments in CAM requires an explicit examination of benefits and costs of management issues and interventions. Comparing the benefits of management with the costs of the preventive or remedial actions, and with the costs of inaction, helps policymakers make more

informed decisions. Such an analysis will help to identify the most socially costly problems and suggest what would be the most cost-effective solutions.

Essential to these comparisons is economic valuation--placing costs on natural resource and environmental damage--so that the magnitudes may be compared with the costs of preventing or mitigating the damage.

New and fairly sophisticated techniques have been developed to place values on nonmarketed and less tangible benefits and costs, but they are not widely used in developing countries. As part of CRMP, several training courses were given on the basics of economic valuation techniques. However, no practical experience was gained by the in-country staff with these techniques.

Economic valuation is discussed in more detail in another paper in this volume.

Formulation of management strategies and policy options

The outputs of the previous stages, namely, the results of the issue-focused research combined with the analysis and synthesis of secondary information provide the basis on which management policy options are formulated, and alternative strategies are developed to address specific management issues.

The process involves both top-down and bottom-up approaches to the formulation of policies, strategies and actions needed to resolve the problems. Plan formulation includes: (1) identification of specific interventions; and (2) preliminary screening of these candidate interventions based on multiple criteria, including economic efficiency, equity and environmental considerations. Economic valuation coupled with extended benefit-cost analysis provide a useful framework for the evaluation of the social, economic and environmental impacts of the alternative interventions.

The output of this stage is articulated as an integrated management plan for the study area. The management plan is comprised of management actions of three general types: (1) institutional and organizational arrangements; (2) public intervention to influence private behavior; and (3) direct government involvement or investment.

Institutional and Organizational Arrangements. Management strategies pertaining to resource utilization, conservation and protection can only be effective if they are implemented within the existing legal framework. Therefore, government involvement is essential for CAM and planning. The CAM plans made without the concurrence of the government will not be implemented.

As far as possible, existing organizations should be tapped to implement CAM plans. The creation of a new institution or agency may not necessarily be conducive for plan implementation, at least in the short term. A new layer of bureaucracy often does more harm than good. Organizations which have been used to a sectoral orientation adjust very slowly to a new management and plan-

ning concept such as CAM unless there are very strong incentives for them to do otherwise. Thus, coordination of existing organizations is imperative.

The existing institutions which govern resource use in coastal areas are of vital interest for CAM. For good management, responsive and effective institutions well suited to local and national traditions are needed. If existing institutions are found inadequate, the appropriate institutional response is to clarify rights and obligations of individuals and government organizations with respect to resource use. This can be done by enacting legislation and developing detailed regulations, building effective administrative structures, appropriating funding and providing for skilled staff.

The legal and organizational aspects of CAM are discussed in more detail in another paper in this volume.

Public Interventions to Influence Private Behavior. When markets fail, there is a role for government intervention to bring individual behavior in line with social goals. The range of policy instruments which can be used by the government to effect the desired changes in behavior falls into two general categories.

The first category includes market-based incentives, such as taxes, prices and subsidies, used to affect the incentives faced by private agents and thus force desired behavioral modifications. The second general category covers the so-called command-and-control instruments, which directly regulate behavior through specification of the legality and illegality of specific actions.

Either of these categories can be targeted directly at environmentally damaging behavior or indirectly at behavior somewhat removed from environmental damage. Both categories require effective monitoring and enforcement capacities, which are often lacking in developing countries.

However, the policy alternatives differ with respect to cost and efficacy. The appropriate mix of these policy instruments--regulations and economic incentives--depend, therefore, on the relative costs of effective implementation. This in turn depends on the type of management issue and the organizational capabilities for implementation.

In theory, a mix of both regulatory and economic instruments are most often preferred. In practice, regulatory instruments often predominate, especially in developing country settings.

In the case of the management plans developed under CRMP, regulatory instruments are most common. For example, in the management plan for Ban Don and Phangnga bays in Thailand, regulation of various activities and direct public investment make up the bulk of the proposed actions (Table 5).

Direct Public Involvement or Investment. Direct public involvement or investment is a popular intervention in CAM. Included in this category are the necessary monitoring and enforcement responsibilities of resource-governing agencies. Direct public investment and involvement in these activities is a necessary complement to regulations and economic-based incentives.

Table 5. Mix of management actions used in the ASEAN/US CRMP-Thailand CAM plan.

Action plan	Action element
Land use	Regulation
	• Land-use zoning
	Direct government involvement/investment
	• Mangrove replanting
	• Education
	• Pilot demonstration of multiple use
	• Pilot soil conservation
Water quality	Institutional/organizational arrangements
	• Promotion of coordination
	Regulation
	• Effluent standards
	• Turbidity standards
	Direct government involvement/investment
	• Water quality monitoring
	• Technical assistance
	• Education
Fisheries	Direct government involvement/investment
	• Research on optimum effort
	• Training
	• Education
Island and coral reef tourism	Institutional/organizational arrangements
	• Institutional strengthening
	Regulation
	• Zonation
	• Setbacks
	• Effluent standards
	• Coral reef products
	• Tourist conduct
	• Beach access
	Direct government involvement/investment
	• Solid waste collection and disposal
	• Education
	• Training

Also included in this category are direct public investments in physical facilities such as water supply systems, sewage collection and treatment systems, parks and protected areas, and activities such as mangrove replanting, coral reef seeding, and placement of artificial reefs. The scale and scope of these types of public investments are constrained by budgetary limitations.

The three budgetary considerations for public investments in physical facilities are: (1) construction or installation of the facility; (2) operation; and (3) maintenance and management. These costs can become burdensome if users of the

publicly provided goods and services do not cover their expenses. Nevertheless, recent studies suggest that people are willing to pay, at least in part, for publicly provided goods and services such as water supply, sewerage and use of marine parks (Whittington et al. 1991; Scura and van't Hof 1992). Therefore, cost recovery should be pursued to the extent feasible through the collection of user fees.

Evaluation, decision and adoption

After plan formulation, a detailed review and evaluation of the alternative management plans is needed. This would entail an extended benefit-cost analysis using multiple-objective criteria, and sensitivity analysis. The results of this evaluation would then be presented to the decisionmakers charged with the selection of the preferred plan or strategy from among the alternatives. If decisionmakers reject all of the alternatives, the plans would be reformulated and resubmitted for subsequent consideration for adoption.

Implementation

There are very few good examples of successful implementation of CAM plans in developing countries. However, in most of the participating countries--Brunei Darussalam, Indonesia, Malaysia, Thailand and the Philippines, the CRMP plans have been officially accepted partly or totally by the government and moves have been made toward implementation.

Within the next several years, these CAM efforts should provide good examples of CAM plan implementation. The management plans developed under CRMP include several aspects of special importance for implementation: (1) integration of essential issues and coordination of relevant actors; (2) local participation in implementation; and (3) mechanisms for monitoring, evaluation and updating of the plan.

Monitoring and evaluation

A feedback mechanism is necessary to monitor, validate and reassess the efficacy of the plan during and after implementation. This process will lead to the refinement of the plan so that it will be more practical, acceptable and effective.

In addition, M&E is a tool for dealing with unanticipated social, economic and environmental consequences of management actions. As such, evaluation measures should focus on the social and economic well-being of the people in the management area, and include any environmental impacts of the interventions.

Lessons Learned

Process-related lessons

Desirable Characteristics of the Planning Phase of the Management Process. The CAM process should have the following characteristics:

1. Management should be viewed as a long-term, iterative and continuous process.
2. It should be perceived as originating from within rather than from outside.
3. Integration with local, regional and national development agenda should be pursued.
4. Local participation by government and communities in policymaking, monitoring and enforcement should be encouraged.
5. Existing institutional and organizational arrangements must be fully considered.
6. Research should be oriented toward improved information and analysis useful for the identification of management priorities and formulation of management strategies.
7. Management actions must be matched with issues and goals.

CAM planning is dynamic and subject to periodic improvements. Once a management plan has been finalized and published, the next step is its adoption and legal sanction by the appropriate executive and/or legislative body. A management plan needs to be legitimized because it must be considered official to be assured the necessary financial allocation for implementation.

The legitimization process of any major government plan is often long and tedious. The plan is often passed back and forth among various government hierarchical levels--local, regional, central--and sometimes gets bogged down in the process. The time is further prolonged when various sectors and communities are consulted.

After plan legitimization, implementation follows. In this stage, resources (manpower, equipment, currency, etc.) are mobilized to execute the various tasks or activities laid out in the plan. This is often hampered by the state's bureaucratic procedures. It often takes time to hire people and procure equipment.

The time frame for each iteration of plan development or revision should be as short as possible, preferably within 2 years. There is considerable lag time between management plan formulation and implementation. In effect, there are two gap periods: between plan finalization and legitimization, and between legitimization and actual implementation. The CRMP experience shows that the total time lag can range from 1 to 2 years.

During this period, some activities can readily be implemented so that the concerned stakeholders and governments can begin to appreciate the results and

impacts of plan implementation. It is important that people see something visible once the plan has been finalized. Good examples are the information dissemination activities. Indonesia has a good headstart on this. The technical refinement of its management plan was already accomplished in 1991. While undergoing formal legitimization, three projects under the plan were implemented early.

Sufficient funds should be allocated to undertake early implementation activities. Hence, the design of a CAM project or program should not stop with either plan finalization or legitimization. In effect, in some instances, management planning could be done simultaneously with the implementation of key projects or activities.

For a plan to be effective, it should be accepted by a majority of the stakeholders. Likewise, it is essential to ensure that the local authority, especially the local planning agency, is heavily involved in management plan formulation. Local identification with the plan increases its probability of being implemented compared with a plan by a consultant or an outside body. An accurate barometer of the degree of acceptance of a management plan is the willingness of the government to allocate financial resources for its implementation. Therefore, it is important that the budget for plan implementation is within the financial capability of the local government.

The planning process adopted by CRMP was very effective in these areas. The CRMP encouraged integration and elicited institutional collaboration; various sectoral agencies, both government and private, cooperated toward common objectives. Earlier planning activities had been highly sectoral. The CRMP also heightened public awareness and participation. The various workshops conducted and educational materials distributed under CRMP contributed to a growing public commitment in ASEAN to promote sustainable development in the coastal areas.

The CRMP utilized almost exclusively national and local research institutions. It proved that given the opportunity and adequate support, the in-country-based institutions could easily handle most of the research required for the CAM initiatives.

Furthermore, the use of local expertise enabled the planning team to keep in close touch with the resource-governing authority. They were therefore kept informed of the latest development or change with respect to new environmental or development legislation that could affect, positively or negatively, the implementation of the proposed CAM plans. For example, in the Philippines, the changes in local government codes toward decentralization accord greater power to the local government. This shift caused a host of local capability issues that resulted in the need for a major refocusing of priorities under the CAM plan to ensure its realistic implementation.

In other areas, the CRMP process was not as strong. Research for CAM in some countries was not adequately structured so that the outputs were not all directly relevant to the formulation of the management plans.

The CRMP planning process was unduly and unnecessarily long; collection of detailed data prolonged the profiling stage. While the extended planning process contributed to the development of local capability, a major focus of CRMP, it also caused the interest and enthusiasm of the policymakers and local government officials to wane due to loss of momentum. In addition, it resulted in the loss of community confidence in the attainment of project objectives due to unfulfilled expectations. The opportunities and constraints for the application of rapid appraisal techniques in CAM to shortcut the planning process are explored in another paper in this volume.

The CRMP research output provided substantiation and quantification of many problems and issues long identified with coastal areas. For example, while the issue of overfishing in Lingayen Gulf, Philippines, was identified during the initial phases of CRMP, further research provided a more detailed scientific and quantitative basis for management actions. The research undertaken showed that given the theoretical maximum sustainable yield (MSY) and the current extraction rate, the gulf is about three times overfished.

Nevertheless, planning must not be too problem-centered either. It must also identify opportunities which may be defined as "factors, conditions, or resources existing in a particular locality which are favorable for development or improvement of the locality" (Sajise et al. 1990). Given too much concentration on the problems, the inherent favorable factors will be largely ignored. A good management plan must have a balanced view of both problems (negative conditions) and opportunities (positive conditions).

One of the weaknesses of the CRMP planning process is the lack of clarity as to whether or not the various elements of the plan are clearly matched. Matching, in the context of management planning, is the strategic and interactive process of harmonizing the key components toward the development of programs and/or projects. In effect, the programs and/or projects are the "package" of things to be done in a plan.

Fig. 8 shows the four major elements of the management plan to be considered to come up with programs and/or projects. These are: (1) institutional capability; (2) CAM goal and objectives; (3) problems and opportunities identified; and (4) wants and preferences of beneficiaries. The process could not be categorized as absolutely objective because subjective judgments would inevitably come in. However, the programs and/or projects are more or less systematically arrived at when screened through these four elements.

The organizational capability element simply pertains to the implementing organizations' capability to undertake the programs and/or projects. Organizational capability includes present capacities indicated by existing manpower, equipment, and financial and/or technological resources including potential capacities that could be generated (Villacorta and Gaon 1986).

The second element is the CAM goal and objectives which must be correlated with the specific objectives of the management plan. The main goal is the pro-

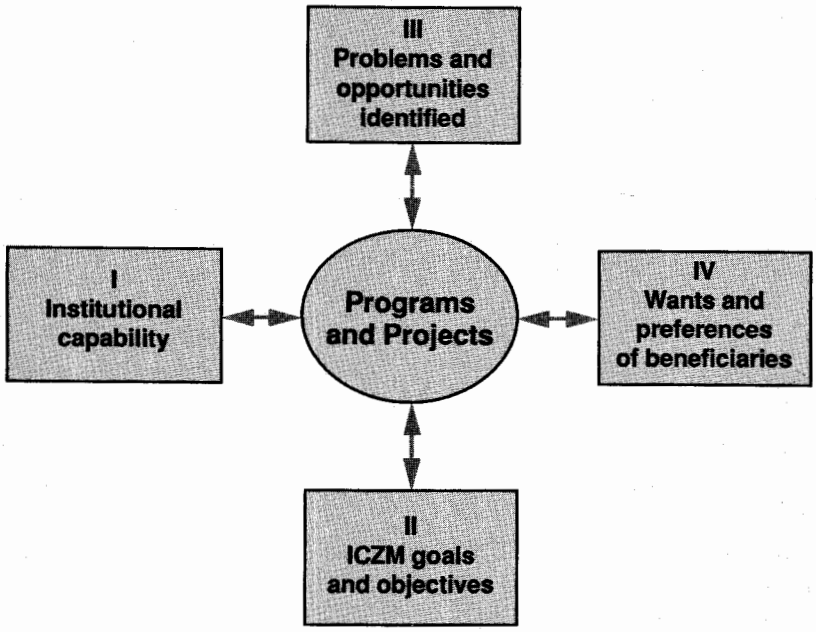


Fig. 8. Matching of four major plan elements to arrive at a set of programs and projects.

motion of sustainable development which ensures the attainment and continued satisfaction of human needs for present and future generations. The specific goals must take into account the wants and needs of the stakeholders in the management area. The objectives are centered on three areas: strengthening multisectoral planning and management; promoting rational utilization of coastal resources and minimizing resource-use conflicts; and maintaining biological diversity, productivity of coastal species and habitats, and the proper functioning of the coastal environment. These must be matched with the issues and opportunities for management intervention.

Essential Features of a Coastal Area Management Plan. In order to ensure that the CAM plan is accepted by the government and to facilitate adoption and effective implementation, the plan should preferably include the following essential features: (1) situation profile; (2) problems and opportunities; (3) philosophy, goals and objectives; (4) policies and strategies; (5) action programs and projects; (6) organization and management; (7) monitoring and evaluation system; and (8) financial and economic justification.

Table 6 presents a comparative checklist of the essential features contained in the CRMP management plans. All of the first six elements are present, although they vary in format and sequence. However, the last two categories are not adequately covered in some of the plans.

Table 6. Comparative checklist of the essential features of the CRMP management plans.

Plan element[a]	Brunei Darussalam	Indonesia	Malaysia	Philippines	Singapore	Thailand
1. Situational profile	x	x	x	x	x	x
2. Problems and opportunities	x	x	x	x	x	x
3. Philosophy, goals and objectives	x	x	x	x	x	x
4. Policies and strategies	x	x	x	x	x	x
5. Programs and projects	x	project only	x	x	indicative only	x
6. Organization and management (O&M)	x	x	x	x	x	x
7. Monitoring and evaluation (M&E) system	limited	none	none	limited	none	none
8. Financial and economic justification	none	limited	none	none	none	none

[a]List modified from Villacorta and Gaon (1986).

Situation profile. The situation profile presents a description of the current status of the coast, including biophysical, socioeconomic, organizational and institutional aspects. The situation profiles produced as part of CRMP were of good quality. However, considerable time was spent in collecting and compiling secondary data, a large portion of which was not needed for planning. While the data gathered enriched knowledge of the area, not all were essential for planning purposes. For example, information relating to demographic, cultural and political characteristics; types and levels of resource exploitation or use; and their contribution to the livelihood of the coastal communities are certainly needed. However, detailed information pertaining to the geology of the soil or the forms and functions of foodchains in the coastal waters were of less practical value for initial planning. Therefore, the types of information needed for a situation profile should be clearly identified before the task is undertaken.

Problems and opportunities. An important feature of a CAM plan is a section which provides an in-depth analysis of the current state of development and its trajectory in the coastal area, and the likely environmental impacts which may result from these activities. The impacts could include, *inter alia*, critical habitat degradation, resource depletion and injury to human health.

Information pertaining to quantification of these effects in physical terms–determination of the level of impacts on the functional integrity of resource systems, human health and productivity–is a necessary but not a sufficient input for the prioritization of the issues. For decisionmaking regarding adverse environmental consequences of human activities, values must be placed on the various impacts to identify which are the most socially costly problems. In short, three basic questions should be answered by this section: (1) What are the current and projected human activities in the area? (2) What are the resulting environmental and natural resource impacts? (3) What are the nature and magnitude of the costs

imposed on society, particularly the coastal communities? These questions are often difficult to answer precisely.

In many management plans of CRMP, problems and opportunities were adequately quantified in a physical sense or assessed qualitatively. Table 7 presents a summary of coastal zone problems identified by CRMP in Thailand. However, questions pertaining to environmental cost were not adequately addressed in many of the management plans.

Table 7. A summary of the CZM problems in Ban Don and Phangnga bays, Thailand.

General problem	Specific problem	Cause and/or problem description
Environmental quality	Water pollution	• Untreated domestic/industrial sewage; dumping of waste petroleum products from boats; and sediment runoff from agriculture, logging, construction and tin mining
	Solid waste pollution	• Indiscriminate dumping from domestic/industrial sources and low handling capacity of waste collection system
	Loss of wildlife habitats	• Forest destruction
	Loss of scenic value	• Construction of buildings, fences and walls close to the shoreline
	Tourism-related problems	• Destruction of natural assets and tourist overcrowding
Resource exploitation	Mangrove forest conversion	• Conversion into shrimp ponds and agricultural uses; extractive uses of mangroves for construction and fuel
	Upland forest conversion	• Conversion into agroforestry and rubber plantations
	Improper agricultural practices	• Crops planted to unsuitable soil, e.g., rubber on sandy soil
	Over- and destructive fishing	• Too much fishing effort; use of small-meshed nets; blast-fishing; displacement of artisanal fishers; and inadequate enforcement of fisheries laws
	Shoreline erosion	• Sand/gravel mining
	Coral reef damage	• Illegal trawling, blastfishing, muro-ami and cyanide fishing; siltation; and tourist activities such as anchoring and collecting corals
	Illegal hunting	• Demand of specialty restaurants for exotic meat
Institutional and organizational issues	Adoption of integrated management plan	• Plan may not be used effectively because accelerated developments "overshadow" planning
	Insufficient or overlapping regulations	• Sectoral nature of laws on resource use in coastal areas which are geared towards short-term economic benefits and nonintegration of development and environmental policies
	Lack of interaction among government agencies	• Lack of coordination and the need to transfer some functions, e.g., fish licenses, from the Harbour Department to the Department of Fisheries
	Inadequate extension work and low public awareness	• Few extension personnel in agriculture/aquaculture; and inadequate public awareness program
	Ineffective law enforcement	• Lack of enforcement due to scarce manpower, equipment and budget
	Socioeconomic inequities	• Outside entrepreneurs favored over local residents

Source: ONEB-MSTE (1992).

Philosophy, goals and objectives. While this feature is usually highlighted in all management plans, a usual weakness is the lack of an operational philosophy and of clearly stated goals and objectives. The philosophies of all CRMP management plans center on the concept of sustainable development. Unfortunately,

this concept is not operational in the sense that it provides little guidance for policy.

Nevertheless, CAM provides a forum for the systematic evaluation of trade-offs among competing coastal activities, and therefore provides guidance for a course of action toward the goal of sustainable development. It is therefore essential in the planning phase to clearly outline the concept of CAM and understand the strength and weakness of its integrated approach. While CAM is not a panacea to the multifaceted problems and conflicts occurring in the coastal zone, it is a powerful planning and management tool, when effectively used, to formulate management actions to address issues of environmental degradation, resource depletion and other use conflicts.

Management measures should center on the promotion of sustainable development by cost-effectively addressing three concerns: (1) adverse environmental and natural resource impacts; (2) use conflicts; and (3) human welfare.

Similarly, goals and objectives should be clearly stated and understood by all parties concerned. The goal should state the broad, ultimate purpose of the plan, while objectives should outline its measurable and attainable ends in a defined area within a given time frame. Not all problems and issues can be solved by CAM in a relatively short time, and prioritization of the issues for management actions is essential. A common problem with CAM planning is the lack of clearly defined objectives. Very often too many objectives are listed, resulting in the dilution of focus away from the critical issues.

Policies and strategies. Policies are formal statements of intentions or general courses of action which support the goal and objectives of the management plan. Levy (1988) defines policy as a set of guiding procedures (e.g., legal) designed to influence the actions and decisions of individuals or groups. In most countries, policy reform is necessary to provide for organizational and institutional arrangements for management plan implementation. Policies for CAM must be formulated within the context of the overall national policy.

Strategies, on the other hand, may be described as specific approaches and actions employed in response to identified problems (Sajise et al. 1990). Strategies are usually articulated through detailed action plans.

Programs and projects. In a conventional sense, a program is hierarchically above a project. Archibald (1976), as cited in Roman (1986), defines a program as a long-term undertaking usually made up of more than one project, while a project is a set of interrelated tasks or activities with well-defined objectives, schedules and budget. A major task in CAM planning is the formulation of programs and projects designed to address critical management issues.

Fig. 9 presents a systems framework of programs designed to solve or mitigate certain problems in Lingayen Gulf, Philippines. Two programs may combine to mitigate a certain problem, e.g., the programs on fisheries management and rehabilitation of critical habitats would lessen the destruction of the latter. Alternatively, one problem may "spin-off" or accentuate other problems, e.g., open

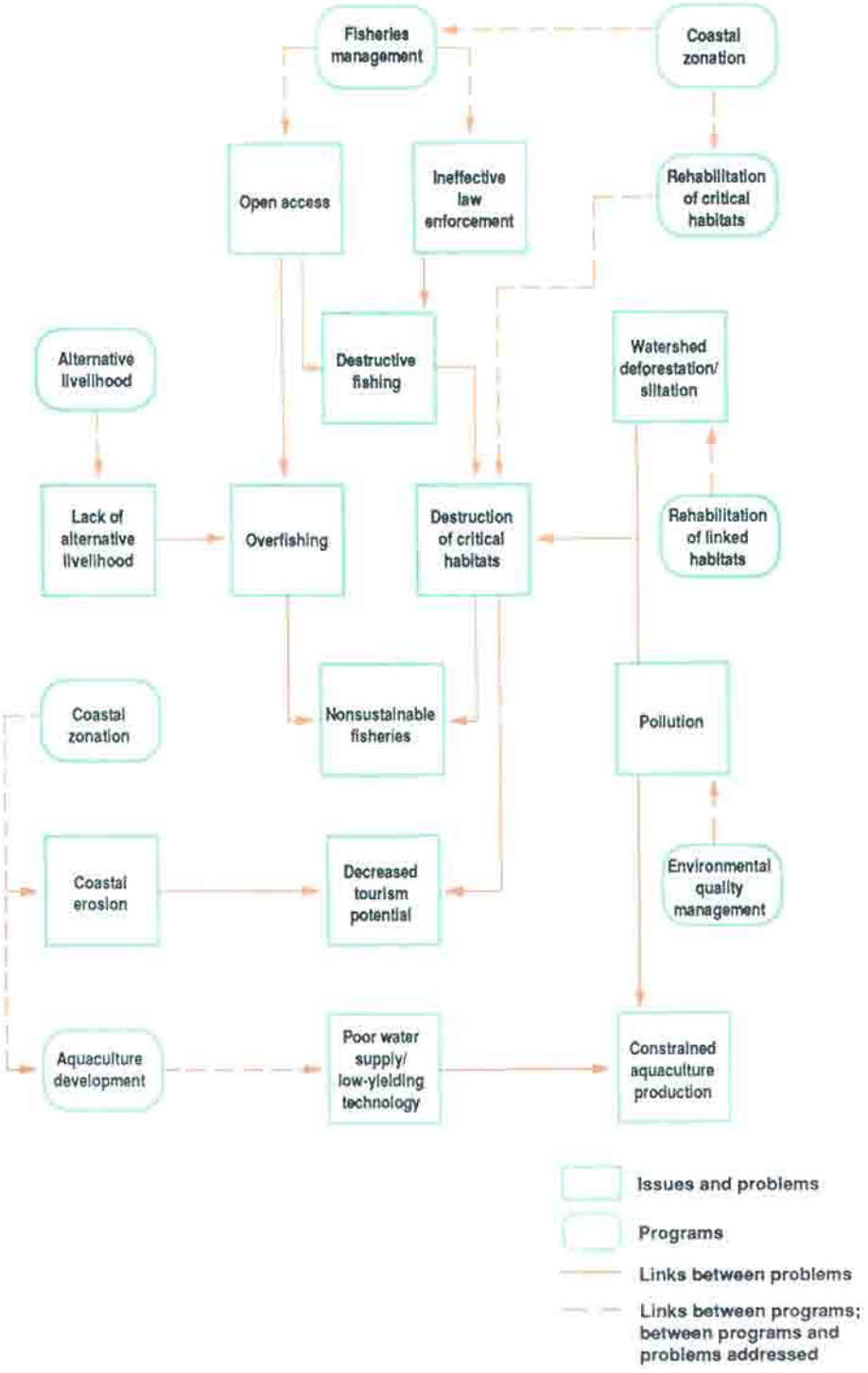


Fig. 9. The integrated approach of the Lingayen Gulf Coastal Area Management Plan (NEDA, Region I 1992).

access contributes to both overfishing and destructive fishing. Table 8 presents the 8 programs and 20 priority projects in Lingayen Gulf. Under the alternative livelihood program, four projects are designed to provide alternative employment for fishers to reduce fishing effort.

Table 8. The Lingayen Gulf Coastal Area Management Plan programs and projects.

1. Fisheries management
   a. Organizing municipal fishers towards establishing common property management
   b. Creating a monitoring system for fisheries management
   c. Upgrading expertise on fisheries management

2. Alternative livelihood for fishing families
   a. Maguey production
   b. Peanut production
   c. Saltmaking
   d. Environmentally sound aquarium fishing

3. Aquaculture development
   a. Feasibility study for a saltwater canal system for fishponds in Binmaley, Pangasinan
   b. Seaweed culture
   c. Seafarming in cages
   d. Oyster culture

4. Environmental quality management
   a. Development of institutional capabilities for monitoring water quality
   b. Information, education and communication campaign against water pollution
   c. Establishment of pilot waste disposal systems for urban and urbanizing centers

5. Rehabilitation and enhancement of critical habitats
   a. Rehabilitation of mangroves
   b. Establishing the Santiago Island community-based marine reserve

6. Rehabilitation of linked habitats
   a. Rehabilitation of the Upper Agno River System watershed

7. Coastal zonation
   a. Geographic information system for coastal area management and planning
   b. Codification of environmental laws and regulations for coastal area management

8. Institutional development

Source: NEDA, Region I (1992).

Among the common programs of the six management plans, zonation is designed both to catalogue the available resources and to ensure their rational utilization to reduce multiple-use conflicts. Fig. 10 is a recommended zonation map of Segara Anakan, Indonesia. The zonation depicted in this map was agreed upon by representatives of a large group of organizations with jurisdiction in the

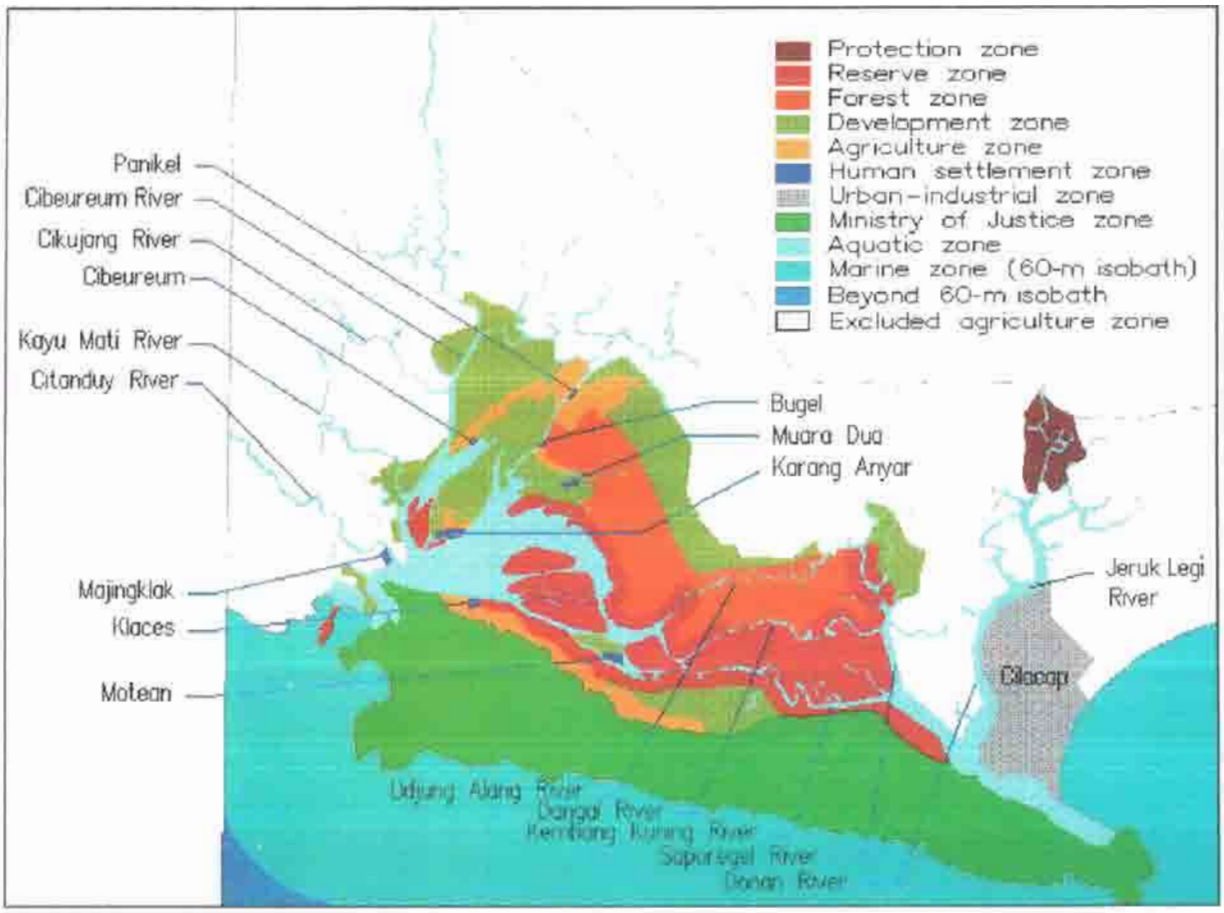


Fig. 10. Recommended zonation map of Segara Anakan (ASEAN/US CRMP, DGF 1992).

area. These included the regional house of representatives, regional planning board, land acquisition, regional social welfare, regional economics, regency board, fisheries service office, state forestry enterprise and Lower Citanduy River project, among others.

Organization and management. The section on organization and management is often left out in management plans because of sheer planning ignorance, especially when the plan is written by nonplanners. It is an important part of a management plan as it outlines the administrative mechanism for effective implementation. Institutional and organizational arrangements are a major component, including the allocation of responsibilities and the legalization of authority, of implementing and coordinating agencies.

The key to successful execution of a CAM plan is the ability to coordinate various implementing agencies and to mobilize available government resources and support from the private sector and communities. Assistance from international bodies is likewise helpful.

Although single agencies exist for integrated management purposes in noncoastal settings, such as for river basin planning and management (e.g., Tennessee Valley Authority in the United States), these are not warranted in a coastal context. In practice, setting up a new agency usually takes time and large investments of public resources, and such agencies tend to be ineffective. As far as possible, existing government structures should be used to implement CAM plans. The organization and management structure adopted by CRMP in all participating countries was one lead coordinating agency with a number of executing or implementing agencies.

M&E system. The M&E section should form an integral part of the management plan. However, this feature is often ignored in plan preparation. The M&E should be conducted periodically throughout the management process, during both the planning and implementation stages.

Monitoring is used to follow the progress of a project or program, and to determine specific changes needed to improve performance. In contrast, evaluation is intended to assess the impacts of the projects or programs (UNCRD 1980). The M&E involving information gathering about the performance and effectiveness of a program/project is conducted at different stages of the management process. CAM program evaluation can take place at the initial phase (similar to project appraisal), ongoing phase, terminal phase or a few years after the completion of the program.

The experience in CRMP showed that M&E, as a project management function, was poorly understood by the national coordinating agencies during the planning stage. As such, M&E was carried out in a rather *ad hoc* manner, although project progress was annually assessed at a regional meeting composed of various representatives of national coordinating agencies.

CAM plans with measurable objectives facilitate M&E exercises. M&Es normally follow standard procedures and time frames. The monitoring procedure

(Saxena 1980) consists of four steps, viz: (1) establishing the level of the expected/desirable performance; (2) identifying and measuring the actual performance; (3) calculating variances between expectations and actual performance; and (4) acting on variances beyond acceptable or pre-established limits.

The M&E can also be used to assess the plan in general. For example, a section on M&E is included in the Brunei Darussalam CRMP plan at two levels–the plan level for the use of top management and the project/program level for the use of those directly involved in plan implementation. Fig. 11 illustrates a simplified design of an M&E system for the country. The CRMP in the Philippines also developed a schematic framework for M&E. However, the other countries did not formulate appropriate M&E systems.

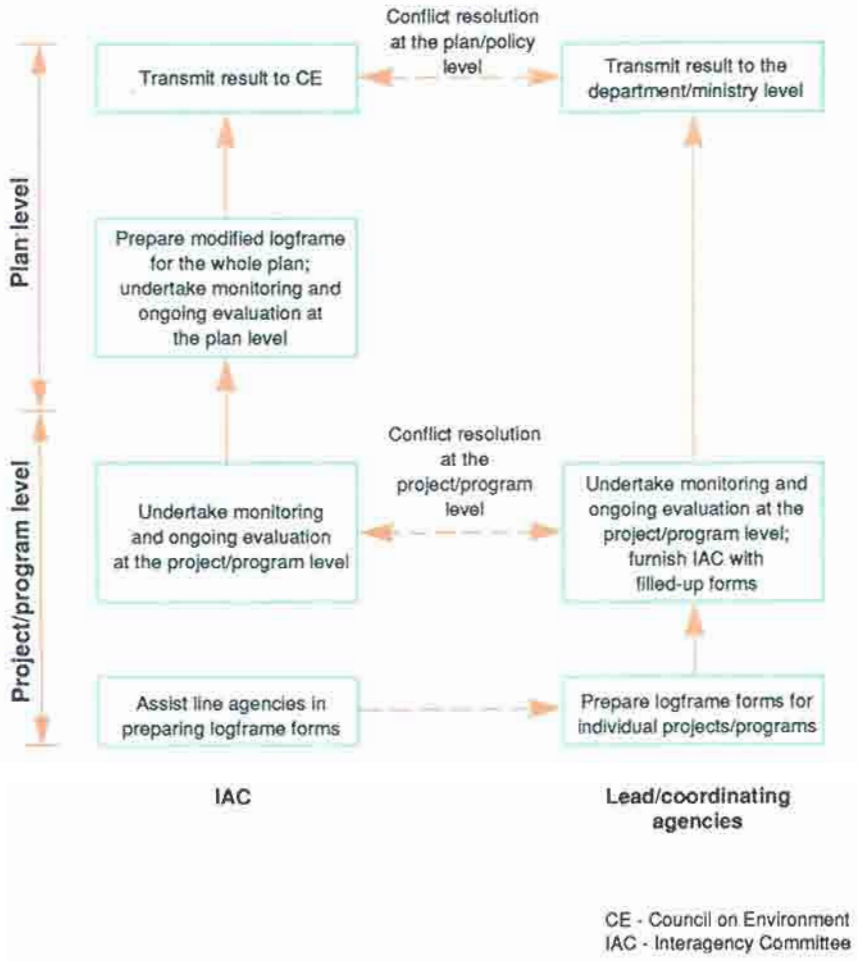


Fig. 11. Simplified chart of monitoring and evaluation (M&E) system framework for Brunei Darussalam's plan (DOF-MIPR 1992).

Financial and economic justification. Financial and economic justification is an essential feature in a CAM plan to provide an idea of its cost and benefits. This is of particular interest to decisionmakers because the plan will require public investments (in terms of cash, personnel, equipment, etc.) which have alternative uses. The implementation budget should be realistic and within the financial capability of the government.

Most participating countries gave estimated budgets for the implementation of the CRMP plans. However, except Indonesia, the other five countries did not come up with indicative economic or financial justification of the plans. This was a major shortcoming of CRMP.

Essential Mechanism of Integration. Integration is an important mechanism in CAM planning and implementation. It allows a more comprehensive perspective of management issues, and concentrates the focus of the management process on the attainment of sustainable development goals. The CRMP experience clearly shows several types of integration appropriate for CAM.

Systems integration pertains to the physical, social and economic linkages of land and water use patterns. It ensures that all relevant interactions and issues are considered.

Functional integration refers to the principle that the programs and projects to be formulated must be internally consistent with CAM goals and objectives.

Policy integration concerns the integration of management with development policies and initiatives. CAM plans should be integrated into local, state/provincial or central government economic development plans to ensure adequate financial allocation and comprehensive execution. As such, it is essential that: (1) the appropriate institution is involved in the planning process; and (2) the format of the CAM plan follows closely that used by the government.

Policy integration is the most difficult but essential aspect of CAM. Integration of management and development is crucial for sustainable development; that is, sustainable development is only possible in the long term if the objectives of both economic growth and environmental management are integrated into overall development plans. This is made possible with a clear government policy for sustainable development and timely adoption of the necessary institutional and organizational arrangements to enable implementation of CAM plans.

Essential Mechanism of Coordination. Coordination is a very significant mechanism in CAM planning and implementation. It brings together various concerned government agencies, community groups, research institutions and NGOs to work toward common goals by following mutually agreed upon strategies.

Coordination functions include close interactions with national steering committees, resource managers in central and local governments, political and community leaders, as well as resource planners and scientists. Also a part of coordination is M&E in the planning and implementation.

Coordination is carried out at various levels. There is a need for vertical coordination, that is, management through close coordination among various hierar-

chical levels of the government: central, provincial, state, regional and local. The key implementor among these depends on the type of management intervention. Regional involvement includes mobilization of regional capabilities for strengthening national efforts in CAM activities, whereas local involvement is focused at the specific management area level.

Horizontal coordination, that is, within a specific level of hierarchy, is also important. For instance, at the local level, the local government coordinates the activities of the various stakeholders or sectors. In addition, temporal coordination is needed to ensure the alignment of various programs/projects over a common time frame. It may be viewed as the synchronization of the phasing of activities.

The multisectoral, interdisciplinary collaboration involving different line agencies of the central and local governments, universities and NGOs in CAM planning and implementation is possible and practically feasible. In CRMP, a large group of institutions and resource and scientific personnel were involved in the project. The highly diverse institutions and individuals somehow cooperated toward common objectives.

There are two important observations, though. First of all, institutions accustomed to sectoral orientation change or adjust very slowly within the framework of an integrated management initiative such as CAM (Tobin, this vol.). Second, formal institutional collaboration works well only within certain bounds. Beyond that, the leadership of the coordinating agency needs to provide considerable influence.

Selecting a coordinating agency, a crucial step, should be based on the following criteria: organizational mandate; experience in integrated planning; availability of multidisciplinary staff; rating with other institutions; and exposure to coastal communities.

An agency with a "neutral" character is preferred (e.g., an economic planning agency either at the central, state/provincial or local government level). Good examples from CRMP are the use of the National Economic and Development Authority (NEDA) in the Philippines and the Office of the National Environment Board (ONEB) in Thailand.

Line agencies with major stakes in the management of coastal and marine resources can also perform the role of coordinating agency (e.g., Department of Fisheries in Brunei Darussalam). The main difficulty, however, lies in integration and implementation especially pertaining to other sectors. Line agencies, because of their inherent sectoral mandates, are likely to elicit organizational rivalry.

Sectoral line agencies with heavy involvement in coastal or marine areas have been playing a key role in coordinating and/or implementing CAM programs in ASEAN. Many of them have been able to obtain support from other agencies. Their main difficulty, however, lies in getting all the proposed sectoral action plans fully integrated into the government's development plans.

Management Issues Considered. There is little doubt that the continued productivity of natural resources and the maintenance of environmental quality in coastal areas are very important to the long-term (i.e., sustainable) economic development of ASEAN members. Management of coastal areas is thus very important. Nevertheless, the nature of the management problems to be addressed in a specific case depends on the characteristics of the coastal area to be managed.

The relative contribution--both current and future--of coastal resources to economic and social development in a particular coastal area depends on resource endowment, current state of economic development and ultimate development goals. These, in addition to the sociopolitical aspects of the planning area, have significant implications for management.

Coastal areas of ASEAN members typically are well endowed with economically important renewable and nonrenewable resources. In most of the ASEAN, these resources directly support such activities as fisheries, forestry, agriculture, mining, tourism and ocean transport. In some coastal areas, these are furthermore important inputs into a host of industrial, manufacturing and service activities.

Although the criteria for selection of the pilot sites differed among the countries in CRMP, the sites chosen tended to be representative of the countries in general. Nevertheless, there are differences in the nature of the coastal problems at the various pilot sites. These differences are highly correlated with the stages of economic development of the areas.

Of the CRMP pilot sites, two are rural (Indonesia and the Philippines), two are urbanizing (Thailand and Malaysia), and the remaining two are urban (Brunei Darussalam and Singapore).

In general, the low- and lower middle-income economies in ASEAN--Indonesia, the Philippines, Thailand and Malaysia--can be classified as natural resource-dependent. That is, the direct contributions of primary producing sectors, such as agriculture (including forestry and fisheries), mining[4], and other directly resource-dependent sectors, such as tourism[5], are quite significant in terms of gross domestic product (GDP), export earnings and employment. For example, in 1990, the contribution of agriculture to GDP in these countries ranged from 12% in Thailand to 22% in Indonesia and the Philippines (Table 9).

As coastal populations increase, a corresponding growth in demand is placed on coastal resources, both directly through a continuation of existing activities, and indirectly as the region's economies mature. The ASEAN economies, particularly the middle-income countries of Thailand and Malaysia, already have

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[4]Data for mining are included under Industry in Table 9.

[5]Data for tourism are included as part of Service in Table 9.

Table 9. Structure of production, ASEAN.

Country	GDP 1990 (x 10^6 $)	Growth rate 1980-1990 (%)	GDP (%) AG share	Growth rate 1980-1990	IND share	Growth rate 1980-1990	SERV share	Growth rate 1980-1990
Indonesia	107,290	5.5	22	3.2	40	5.6	38	6.7
Philippines	43,860	0.9	22	1.0	35	-0.8	43	2.6
Thailand	80,170	7.6	12	4.1	39	9.0	48	7.8
Malaysia	42,400	5.2	-	3.8	-	7.1	-	4.2
Singapore	34,600	6.4	0	-6.2	37	5.4	63	7.2
Brunei	-	-		-	-	-	-	-

AG - agriculture
IND - industry
SERV - services

Source: WB (1992).

begun the process of diversification. As a normal part of this economic structural adjustment, natural resource-based sectors contribute a decreasing share to GNP as economies evolve to be more diversified. With the exception of the Philippines, the growth rate of the manufacturing and service sectors in these countries over the period 1980-1990 far exceeded growth in other, more directly resource-dependent sectors.

Nevertheless, while diversification may reduce direct dependence on natural resources in relative terms, indirect dependence will likely increase. First of all, structural transformation of developing economies is preferably financed through domestic investment. An important source of this much needed capital is the continued productivity of natural resource-based activities. Furthermore, as diversification progresses, natural resources become inputs into a variety of economic activities, in addition to being used as primary commodities, thus increasing the value added to the economy.

The types of management issues which predominate are a function of the mix of development activities in an area, and are therefore highly correlated with stages of economic development. Traditional management issues--those related to the rates of exploitation of natural resources--tend to be problems which predominate in undiversified economies, such as those which typify rural areas. Oftentimes, the solution to these problems, at least in part, is found in economic diversification which brings with it alternatives for those dependent on natural resource exploitation.

Therefore, as economic development progresses in a coastal area, there can be a management issue transition driven by economic diversification. The transition is from the traditional to the more modern management issues--those related to pollution--which tend to predominate in more diversified economies, such as those which typify urban and urbanizing areas.

The principal effect of environmental problems in rural and urban settings differs. Whereas in rural areas overexploitation or degradation of natural resources

and the resulting loss of natural resource productivity are the primary concerns, by far the main costs of coastal mismanagement in urban areas are related to impacts on human health--particularly acute morbidity, increased risks of chronic diseases and of premature death--and productivity.

The main coastal problems in urban areas are related to pollution--degradation of water quality and, increasingly, inadequate disposal of solid and toxic wastes. While the same general categories of pollution problems can be found in rural and urbanizing settings, urban pollution differs both in scale and in scope from the rural one. The population density and concentration of production and consumption activities in urban areas combine to produce waste orders of magnitude more than could be handled by natural assimilative mechanisms. Also, concomitant with the industrialization trend that currently typifies economic growth in urban areas in ASEAN is the production of "modern" wastes, such as synthetic organic chemicals, which do not occur naturally and by their very nature are dangerously persistent.

Well-intended development efforts focused on diversification of economies--structural changes which create a new mix of economic activities--often inadvertently create problems for existing activities. For example, increased abstractive uses of river water, such as for irrigated agriculture, can cause significant salinity-related problems in estuarine areas due to reduced freshwater inflows. Similarly, improper siting of municipal and industrial development in coastal areas can cause loss of critical habitats, such as wetlands and mangroves. In addition, water pollution from domestic, industrial, agricultural and aquaculture sources is a typical result of unmanaged development. All of these, individually and collectively, can adversely affect the productivity of coastal resource-based activities, human health and the aesthetics of coastal areas (Table 10).

In the transitional stages, there tend to be a dualism and synergism of management issues. In the absence of the management of coastal areas undergoing diversification, there tends to be a coexistence of traditional and modern management issues. Oftentimes, the traditional issues are exacerbated by the more modern ones. For instance, loss of fisheries productivity due to overfishing is aggravated by deteriorating water quality and conversion of a habitat into other uses.

In the low-income countries of the Philippines and Indonesia, rural sites were selected where classic problems of open access and overexploitation of natural resources predominate. Both Lingayen Gulf and Segara Anakan are characterized by intense exploitation of potentially renewable resources, particularly fisheries, coupled with very poor economic status of coastal communities and land-use problems.

In the middle-income countries of Thailand and Malaysia, urbanizing sites were chosen for CRMP where economic diversification is beginning to add complexity to coastal issues. Development activities in the coastal areas of Ban Don and Phangnga bays and South Johore, ranging from tourism through mining to

Table 10. Main consequences of the mismanagement of coastal areas.

CAM issue	Effects		
	Health	Productivity	Aesthetics
Depletive/destructive resource use			
• overfishing	reduced nutrition of poor fishers	loss of fisheries production	loss of fish diversity
• overcutting of coastal forests	reduced nutrition of traditional collectors of nontimber forest products	loss of forestry production; loss of nonmarketed forest products	loss of unique vista
• overpumping of water	increased health risks due to water scarcity	irreversible loss of water supply; salinization	unsightly sink hole due to subsidence
• sand mining	increased risk of injury from storms/flooding	loss of physical assets due to erosion	loss of unique vista
Loss of habitats			
• destruction of coral reefs/ seagrass beds	reduced nutrition of poor fishers	decline in fisheries; tourism decline in storm surge protection	loss of unique vista; loss of fish diversity
• conversion of mangrove areas	reduced nutrition of traditional collectors; increased risk of injury from storms/flooding	decline in aquaculture, fisheries; loss of forest products; decrease in storm damage protection	loss of unique vista; loss of wildlife diversity
• land reclamation/draining of wetlands	reduced nutrition of traditional collectors; increased risk of injury from storms/flooding	decline in fisheries; loss of marketed and nonmarketed wetland products; increased flooding damage	loss of unique vista; loss of wildlife diversity
Pollution/environmental degradation			
• water pollution	contamination of seafood; water unsafe for recreation/bathing	decline in aquaculture, fisheries, tourism	offensive smell
• sedimentation	contamination of seafood; water unsafe for recreation/bathing	decline in aquaculture, fisheries, tourism	unsightly
• reduced freshwater inflows	increased health risks from waterborne diseases due to water scarcity	decline in aquaculture, fisheries	
• solid waste disposal	increased risks of disease transmission through various vectors	decline in aquaculture, fisheries, tourism	offensive smell; unsightly

industry, will exacerbate existing coastal resource-use problems unless adequate management measures are put in place.

In the high-income countries of Brunei Darussalam and Singapore, the CRMP sites are the entire countries which are predominantly urban. In comparison to other CRMP sites, the coastal issues are of a very different nature in these countries. For Brunei Darussalam, its coastal resources are currently among the least exploited in the region due to the economic dominance of the oil and gas sector. However, government development plans focused on economic diversification could have a significant impact on these resources. In this case, the integration embodied in CAM provides a mechanism for the rational management of resources to ensure their contribution to sustainable development.

The development trajectory of Singapore over the past 26 years has been geared toward urbanization. Land scarcity in the island-nation, and the resulting

high opportunity cost of land in natural uses, led to an aggressive coastal land reclamation program. Land reclamation activities significantly affected coastal areas and nearby waters. The main coastal issues in Singapore relate to coastal pollution, both deterioration of water quality and solid waste disposal, and loss of unique coastal areas of aesthetic value.

The CRMP experience suggests a typology of coastal management issues which commonly occur with specific stages and levels of development (Fig. 12). This typology allows for the identification of management issues likely to be encountered with current stages and levels of development. It also allows CAM planning to be more forward looking through the anticipation of management issues which will probably arise with economic diversification and urbanization.

Institutional setting-related lessons

Specific Resource Focus. Clearly, a coastal resource systems approach has many advantages to planning and management of coastal areas. Rather than concentration on one resource or set of resources, such as fisheries, the focus is on the broader role of coastal resources generally in sustainable development (Box 8). While fisheries might play a significant role now, this situation might change over time. No particular resource or economic activity is sacrosanct.

Nevertheless, throughout the region, the fisheries sector is a passive victim of many of the intersectoral effects on coastal areas, that is, negative externalities resulting from activities in other sectors. For instance, the problems of fisheries are often described as the double threat of excessive fishing pressure and degradation of the aquatic environment. These problems originate, by and large, outside the fisheries sector.

In developing countries, labor displaced from other sectors such as agriculture and industry, and with no other employment opportunities, is dumped into the small-scale fisheries sector as a result of open access.

Habitat degradation has multiple extra-sectoral causes. Some major causes of water quality problems include inadequate treatment of sewage and industrial effluents, improper disposal of solid waste, and reduction of freshwater flows into estuarine areas resulting from increased water withdrawals upstream. Similarly, the main causes of loss of critical habitat are conversions for use in other sectors, such as aquaculture and industry.

As a result, solutions to fisheries sector problems also have their origins, to a large extent, outside the sector. Nevertheless, fisheries is the single sector that has the most to gain if management is undertaken, and has the most to lose if it is not. Rather than passively accept these impacts from other sectors and expect that initiatives be taken by others to mitigate these effects, the fisheries sector has a vested interest in taking a leadership role in CAM.

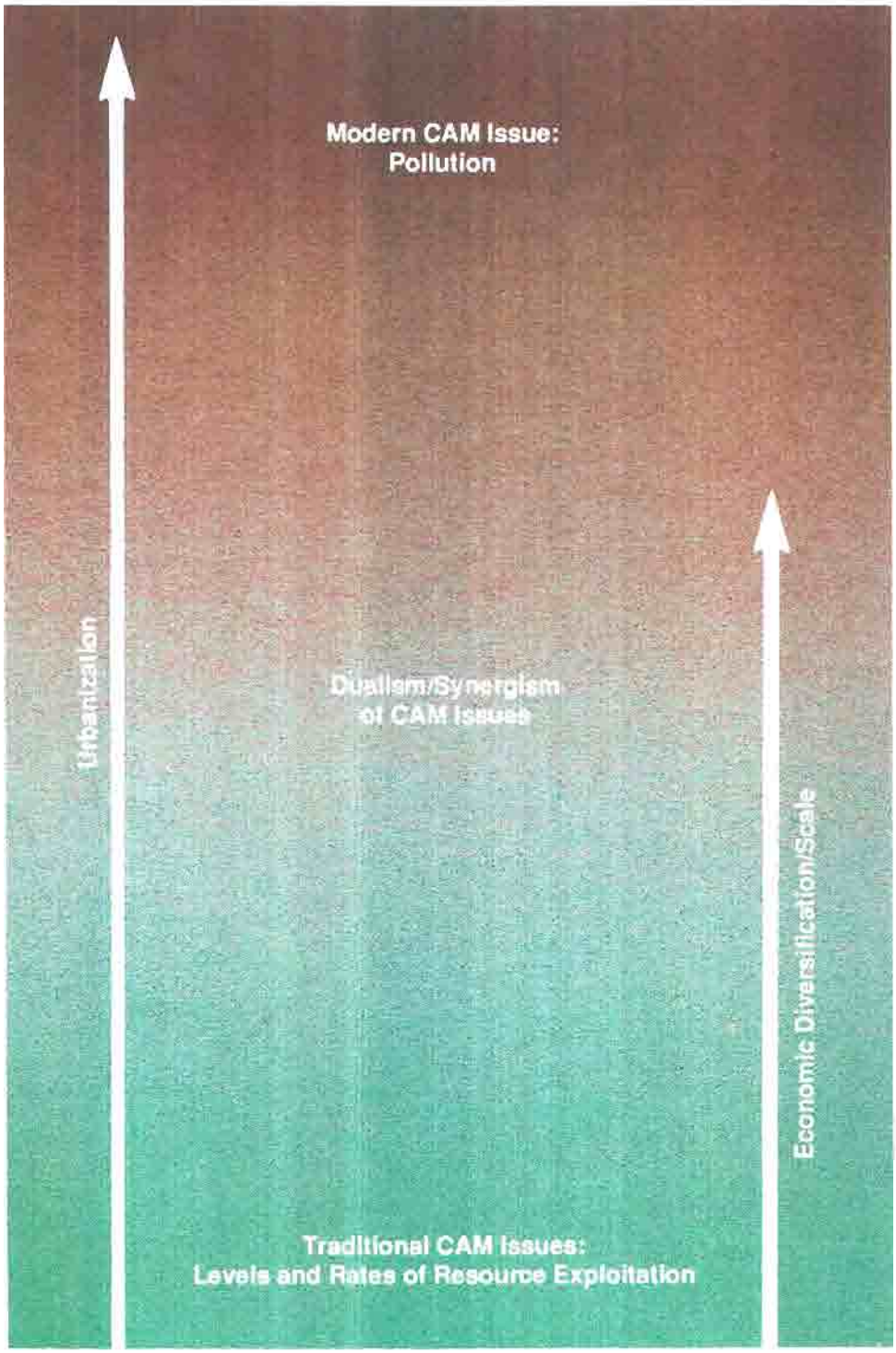

Fig. 12. Typology of coastal area management issues.

Box 8. "Sustainable fisheries" vs. "the role of fisheries in sustainable development."

Fisheries sector management problems are often described as originating from a two-pronged threat: overexploitation and habitat degradation. The first is the traditional fisheries management issue of nonoptimal exploitation of fisheries resources caused by excessive fishing effort. Excess effort results from a combination of too many fishers and too powerful gear. The other threat to fisheries stems from the more modern problem of habitat degradation, including deterioration of water quality and loss of critical habitats such as coral reefs and mangrove areas.

In the case of nonoptimal resource exploitation, the essential management issue relates to exclusion of access. In cases where rights of access to the resources are unclear or unenforceable, exclusion is not possible or is very expensive. However, to not exclude is also costly.

Under conditions of open access, the long-run equilibrium fishing effort (OAE) is way above the biological maximum sustainable yield (MSY) and even further above the most economically efficient maximum economic yield (MEY) (Fig. A). The MEY brings the most economic benefits. It is the yield at which resource rents—values accruing to unpriced resources used in the fishery such as the fish stocks themselves and undegraded habitat—are maximized. At OAE, resource rents are driven to zero.

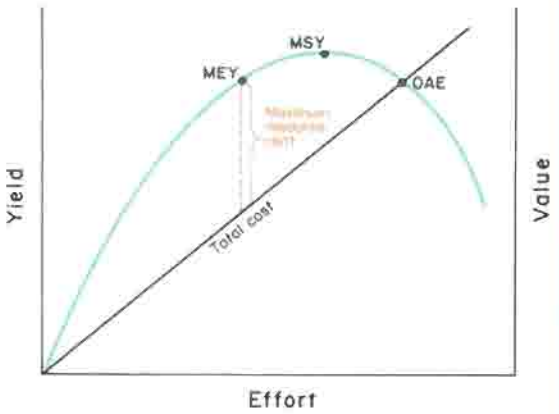

Fig. A. Comparison of OAE, MSY and MEY under conditions of open access.

Therefore, if fisheries are not managed, resource rents are dissipated. If, as under conditions of open access, the resource rents are completely dissipated, no benefits accrue to society as a result of the use of these resources in the fishery. The value of the benefits derived from the fishery just equals the value of the priced inputs, such as capital and labor, used in the capture process.

If effort is restricted so MEY is achieved, the resource rents, including those to fish and other resources which together constitute habitat, are maximized. However, even when effort is restricted and the resource rents are sustained at the maximum, these may not be greater than the opportunity costs of the resources in alternative uses.

Expanding the MEY concept to include the opportunity cost of undegraded habitat (EMEY) and the costs of management gives a better indication of the relative value of the resources. Two scenarios are possible (Fig. B). First of all, inclusion of opportunity costs of unpriced inputs in the fisheries production process could shift the total cost curve from TC^0 to TC^1 (a parallel shift unrelated to level of effort) which would result in MEY being equal to EMEY. This would mean that even with opportunity costs accounted for, the most efficient level of yield is still the same, although the rents accruing to fishing would be reduced by the amount of the management costs.

Additionally, inclusion of management costs necessary for the fisheries sector could result in a shift from TC^1 to TC^2 (a non-parallel shift related to the level of effort) which

Continued

Box 8. (continued)

would result in EMEY being less than MEY. This would mean that with opportunity and management costs accounted for, the most efficient level of yield would be lowered, and the maximum rent to the fishery would be reduced. If this lower maximum rent is greater than zero, then fishing is the best use of the resources in question. If it is less than zero, it would be efficient to reallocate some of these resources to uses other than fishing.

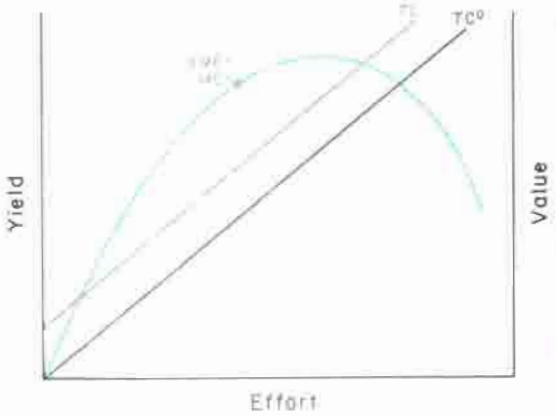

Fig. B. Two possible scenarios when opportunity costs (TC^2-TC^1) and management costs (TC^1-TC^0) are included in the MEY concept.

The management implications of the foregoing analysis are several. First, fisheries are not sacrosanct—and the term "sustainable fisheries" is not a very useful guide for policy. More appropriate is the optimum role of fisheries in sustainable development as the fisheries management objective.

The analysis also implies a priority for dealing with the two sets of fisheries sector problems. The potential benefits of habitat protection will not be realized under condition of open access where resource rents are lost. Therefore, problems of open access must be dealt with, or there is no societal incentive to deal with the problems of habitat degradation.

Furthermore, even if fisheries are managed effectively, there may be instances when the opportunity cost of the resources in the production process is so high that fisheries logically becomes a low priority. Such a case is demonstrated by Singapore, where fisheries is a low priority as compared with land reclamation.

Bottom-up Vs. Top-down. The application of bottom-up or top-down approach in CAM planning depends on the political, cultural and socioeconomic conditions of the country concerned. While there is an increasing advocacy for the bottom-up approach, its total adoption in many Southeast Asian nations may not be politically or culturally acceptable.

The top-down approach, while maintaining sufficient public consultation, is suitable in Brunei Darussalam, Malaysia, Indonesia and Singapore (Chua 1989). However, the bottom-up approach is definitely feasible in the Philippines. In Thailand, a mixture of these approaches may be more appropriate.

The political climate in most Southeast Asian nations is favorable for people's consultation and involvement of public and private sectors in CAM. In fact, local participation in policymaking, monitoring and enforcement is desirable. However, the major decisionmaking authority still lies within the legislative right of the political leadership.

Choice of Interventions. Of the available intervention instruments, most countries–developed as well as developing–typically use direct regulation to deal with natural resource and environmental management issues generally, and CAM issues specifically. This has also been the experience of ASEAN in CAM (Table 11).

Table 11. Major management actions contained in ASEAN/US CRMP CAM plans.

Management action	Brunei Darussalam	Indonesia	Malaysia	Philippines	Singapore	Thailand
Institutional and organizational arrangements						
Legal framework	x		x		*	x
Clarification of use rights				x		
Coordination/clarification of jurisdictions and roles	x	x			*	x
Manpower development	x	x		x		
Interventions						
Market-based incentives						
Unspecified				x		x
Alternative livelihood		x		x		
Aquaculture development		x		x		
Fishing licenses			x			
Regulations						
Zonation	x	x	x	x		x
Pollution	x				*	x
Fishing effort/gear	x	x				x
Beach setback			x			x
Coral products						x
Tourist conduct						x
EIA	x				*	
Direct public investment						
Public education		x		x		x
Parks and protected areas	x		x	x	*	x
Tree replanting	x			x		x
Solid waste management	x		x	x	*	x
Water quality monitoring		x		x		x
Artificial reef dredging		x			*	

*Recommendations only.

The CRMP experience suggests a typology which relates institutional and organizational considerations to the appropriate use of management actions (Table 12).

The use of direct regulations is a suitable strategy in many instances. For controlling management issues involving only a few resource users, direct regulations can work well because monitoring and enforcement of compliance are feasible. Direct regulations are, in fact, preferred in cases where the target resource

Table 12. Institutional and organizational considerations for effective management actions.

Consideration	Direct	Indirect
Market-based incentives		
Clarification of rights and obligations necessary	Yes	Yes
Monitoring and enforcement requirements	High	Medium
Financial commitment	High	High
Revenue generation/cost recovery possible	Yes	Yes
Maximum number of target resource users	Small	Large
Command-and-control regulations		
Clarification of rights and obligations necessary	Yes	Yes
Monitoring and enforcement requirements	High	Medium
Financial commitment	High	High
Revenue generation/cost recovery possible	No	No
Maximum number of target resource users	Small	Large
Direct public investment		
Clarification of rights and obligations necessary	Yes	No
Monitoring and enforcement requirements	High	Low to none
Financial commitment	High	High
Revenue generation/cost recovery possible	Yes,but not typical	No
Maximum number of target resource users	Small	Large

users are insulated from competitive pressures and therefore would not readily respond to market-based incentives. Direct market-based incentives work best when targeted at only a few competitive resource users, as these interventions also require the capability to monitor and enforce compliance.

However, many coastal environmental issues are created by the activities of many small-scale resource users. As a result, compliance with direct regulations and direct market-based incentives are often difficult to monitor and enforce. This is especially relevant if financial and human resources in enforcement agencies are constrained as they typically are in developing countries. In these cases, indirect regulations and indirect market-based incentives, although theoretically less efficient, are preferable.

Direct policies target the management issue directly and therefore produce desirable and immediate results. In contrast, indirect policies are blunt instruments in the sense that they target factors which influence management issues, not the issues themselves.

For example, indirect market-based incentives, such as establishment of alternative livelihood programs, are focused on drawing excess effort away from open access resources by providing viable alternatives. If used in combination with the means to directly restrict effort over the long run, this indirect intervention can be very effective.

Indirect regulations can also work well. Zoning in coastal areas is used for two purposes: to protect unique coastal environments, such as mangroves, through a conservation designation; and to segregate disparate and conflicting land uses, thus reducing the likelihood of occurrence of negative spillover effects.

Direct public investments are also popular among the CRMP plans. Examples of these include mangrove replanting, placement of artificial reefs, establishment and operation of marine parks and protected areas, and educational and alternative livelihood programs.

Implications for Research

Further research is needed to improve information and analysis for a better input to priority setting and policy design. Box 9 gives an overview of the key research areas for CAM.

In terms of information for priority setting, the biophysical, social and economic aspects of the coastal resource system are important. First, a better understanding of the ecological function of a critical coastal habitat, as well as current and future human activities, is needed. More specifically, natural resource and environmental impacts associated with coastal activities have to be quantified in a physical sense, and monetary values placed on these impacts. Further research is needed to add to the understanding of the interactions between human activities and the marine and terrestrial environments within the coastal resource system.

In terms of analysis for priority setting, the appropriate focus is the identification of the most socially costly management issues which need to be addressed. This will require explicit evaluation of the benefits and costs associated with the tradeoffs among and between alternative coastal activities.

For policy design, further research is needed to provide guidance to developing country policymakers for establishing policies and programs and selecting policy instruments aimed at the resolution of specific CAM issues. This research should include studies on the appropriateness and efficacy of various regulatory and market-based instruments, given conditions which typically predominate in

Box 9. Key research areas for CAM.

The ASEAN/US CRMP experience suggests that research should be directed at the following areas.

Understanding Interactions in Coastal Resource Systems

- Understanding the ecological function of critical aquatic resources, habitats or ecosystems (e.g., coral reefs, mangroves, marshes/wetlands).
- Identification of trends in supply and demand for goods and services derived from coastal resources and habitats, and social and economic factors influencing these.
- Interpretation of implications for management of carrying capacity or assimilative capacity of aquatic habitats or systems. Identification and documentation of critical threshold levels and indices for management.

Identification and Prioritization of Management Issues

- Identification, physical quantification, and evaluation of tradeoffs and trends of impacts in coastal areas.
- Identification of a general typology relating occurrence of specific management issues with biophysical, socioeconomic and institutional and organizational factors.
- Valuation of social and environmental benefits and costs of sectoral activities.
- Identification of management priorities through evaluation of the sustainable level of output, adverse impacts, and associated net benefits and costs.

Identification and Evaluation of Management Strategies and Actions

- Identification and evaluation of appropriate policies and management strategies to mitigate negative impacts and maximize human welfare benefits.
- Identification of general guiding principles with respect to appropriate management action elements including (1) market-based incentives, (2) regulations, (3) direct public involvement or investment and (4) institutional and organizational arrangements.

Development of Methodologies and Tools

- Evaluation, integration and packaging of appropriate, cost-effective methodologies and techniques to facilitate the inventory of resource distribution, utilization and impacts within the coastal resource system.
- Evaluation, integration and packaging of appropriate, cost-effective methods and techniques for the evaluation of benefits and costs of coastal activities and management interventions.

developing country settings. The studies should focus on aspects related to the prerequisites for successful implementation of various instruments, the mix of instruments most appropriate under different developing country conditions, and the practicality and cost of implementation of the various instruments.

For both priority setting and policy design, existing analytical tools need to be refined and new techniques developed.

Conclusion

A recent World Bank report (1992) on the subject of development and the environment provides a series of suggestions intended to guide the actions of national policymakers with regard to the environment. Among these are to:

1. build the environment into policymaking;
2. act first on local issues;
3. focus on prevention rather than cure;
4. assess tradeoffs and minimize them;
5. economize on administrative capacity by using, to the extent feasible, interventions that work with the market; and
6. support research, disseminate information and train staff.

The recent United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro was the expression of an unprecedented political constituency for addressing environmental issues. Chapter 17 of UNCED Agenda 21, which was adopted by the conference, calls for new approaches to development and management of coastal resources, that are "integrated in content, and precautionary and anticipatory in ambit." Explicitly included as a recommended program area is integrated management and sustainable development of coastal areas.

CAM provides a framework to operationalize the World Bank and UNCED recommendations in the context of coastal areas. The desirable characteristics and essential mechanisms of the CAM process are discussed in this paper. Integration and coordination ensure that the environmental consequences of activities are given full consideration in development planning and implementation. Local consultation and participation ensure that plans prioritize and address issues that are of local importance.

The experience of CRMP highlights the coastal resource system as the appropriate level of analysis and planning. From the coastal resource system perspective, transectoral effects can be identified and physically quantified, tradeoffs assessed in terms of impacts on human welfare, and these impacts minimized through appropriate institutional and organizational arrangements and management interventions.

The preliminary typology of management issues suggested by the CRMP experience will undoubtedly be expanded and refined through further CAM experiences. Nevertheless, the current typology provides a vision which should allow management to be proactive rather than reactive, and to focus on prevention rather than on cure.

Similarly, the typology of institutional considerations suggested by the CRMP experience provides a preliminary assessment of the relative efficacy of alternative management interventions, including market-based incentives, regulations, and direct public investments such as research, information dissemination and training.

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The ASEAN/US Coastal Resources Management Project: Initiation, Implementation and Management*

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Abstract

A major regional undertaking, the ASEAN/US Coastal Resources Management Project (CRMP) generated substantial information and experience in integrated coastal zone management (ICZM) in its six-year duration. This paper outlines the process and approach in project design and implementation. The project's main component was the development of site-specific ICZM plans in the respective participating countries. The achievements and lessons learned from CRMP shaped an ICZM typological framework applicable to other developing nations.

Introduction

The ASEAN/US CRMP was initiated in 1984 by the Working Group on Marine Science (WGMS) of the ASEAN Committee on Science and Technology (COST) and jointly funded with the United States Agency for International Development (USAID). This regional project was a major undertaking and over

*ICLARM Contribution No. 871.

the six years of its implementation generated a wealth of information and experience in ICZM. Unprecedented in the history of ASEAN, CRMP addressed a host of complicated developmental and environmental issues common among the countries in the region. The project, largely coordinated and implemented by ASEAN nationals through an intricate but effective organizational network, focused on collaborative research, training and information exchange.

The purpose of this paper is to systematically document the process and approach in project design and implementation, with particular emphasis on the management aspects. The lessons learned from this project pertaining to the development of an ICZM program are treated by Scura et al. (this vol.). Some useful methods with application to ICZM are covered in separate articles by Kam et al., Pomeroy, and Pido and Chua (this vol.).

Background of CRMP

The possibility that USAID would cofinance a marine resource management project spurred some marine scientists of the region to submit the relevant country proposals through the appropriate ASEAN channel--WGMS-COST Standing Committee--for funding support during the ASEAN/US Dialogue. The approval led to a series of preparatory meetings involving experts recruited by USAID and those from the region. By mid-1985, a project document was finalized and ready for execution. The International Center for Living Aquatic Resources Management (ICLARM) was appointed to execute the project and provide technical and administrative support. At the same time, it would help ICLARM develop in-house capabilities in coastal resource management (CRM) to extend similar assistance to other developing countries.

Initially, Indonesia, the Philippines, Singapore and Thailand participated in the project; a year later, Brunei Darussalam and Malaysia joined, too, resulting in a change of budgetary allocation of US$5 million from four to six countries. Two years later, the project received a supplement of US$800,000 from the donor.

The project was officially launched in January 1986 with the coordinator taking up office at ICLARM. The project management structure was in place three months later. Project activities in each of the four participating countries were undertaken after the first Project Steering Committee (PSC) meeting where the workplans of the project and those of the participating countries were approved.

Project Goal

The goal of CRMP was to increase national capabilities within ASEAN for developing and implementing comprehensive, multidisciplinary and environmentally sustainable CRM strategies through:

- analyzing, documenting and disseminating information on trends in coastal resource development;
- increasing awareness of the importance of CRM policies and identifying, and where possible, strengthening existing management capabilities;
- providing technical solutions to coastal resource-use conflicts; and
- promoting institutional and organizational arrangements that bring multisectoral planning to coastal resource development.

Project Design and Focus

The goal of the project and the implementing strategies listed above served to guide project design and activities. The initial project design provided a broad conceptual framework within which detailed workplans were developed. Each year, representatives from each of the participating countries, together with project staff and people from the donor agency, met to discuss project progress and approve workplans for the subsequent year. This system provided an effective avenue for project modifications and realignment of funds.

The project focused on the following areas:

1. human resource development - by undertaking short-term and academic training to strengthen existing capabilities;
2. public awareness - by producing educational materials on the ecological and socioeconomic contributions of the natural resources and the consequences of unsustainable exploitation;
3. political will - by organizing policy workshops involving relevant policymakers and lawmakers to increase their understanding of and commitment to the sustainable use of natural resources and appropriate actions to arrest further destruction of the resource base;
4. ICZM program - by establishing case studies in pilot sites of the six countries.

The first three activities were executed through the project office at ICLARM. All participating countries developed their own ICZM programs.

Because of multisectoral and multiagency involvement in the project, it was necessary to clearly define the scope, approach, organization and management protocol. These were discussed and agreed on by the participating countries. Guidelines for CRMP implementation and evaluation were produced by the project office for information and guidance on budget allocation, capacity building, reporting protocol, project monitoring and evaluation and management of various tasks (ASEAN/US CRMP 1986).

A standard organizational structure was established for all the participating countries in undertaking in-country projects (Fig. 1). The National Steering Committees (NSC) were composed of the heads of the key implementing agencies. The chairman of the NSC in each country was usually the head of the coordinating or the lead implementing agency and automatically a member of PSC. The activities within each country were overseen by a national coordinator.

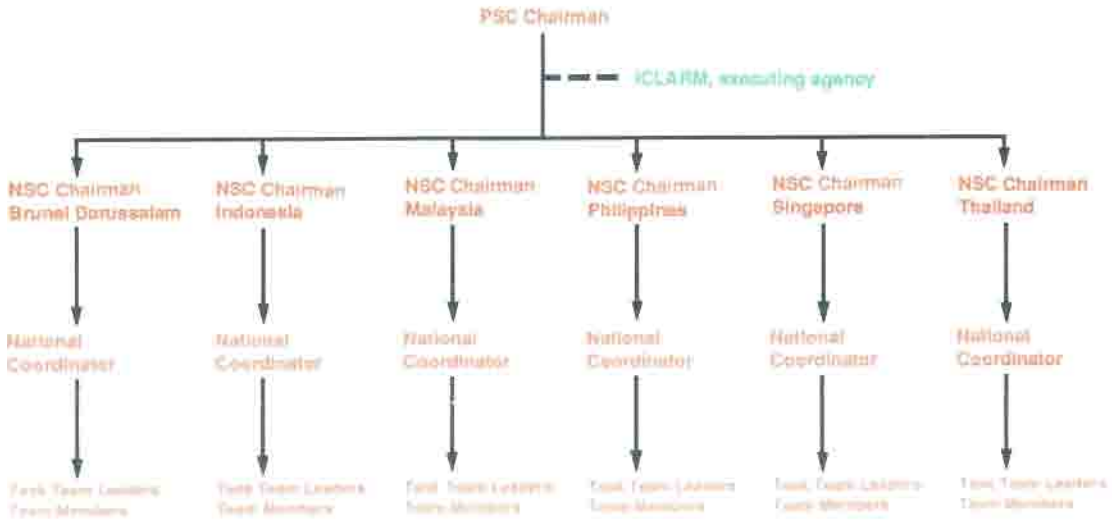

Fig. 1. ASEAN/US CRMP organizational chart.

Development of area-specific ICZM plans and programs

This is the major component of the project. Each participating country developed its specific activities and workplan for the duration of the project and an annual workplan. The in-country project plans were then discussed and approved with the necessary modifications by PSC. The executing agency (ICLARM) was responsible for assisting in the development and modifications of in-country project activities.

Selection of Pilot Sites. Pilot sites were chosen by the respective countries based on mutually agreed criteria:

- the presence of economically significant coastal fisheries, particularly small-scale capture fisheries and aquaculture;

- the coexistence of coastal development efforts that compete for limited resources;
- the direct relationship of management issues in the pilot coastal areas with national priorities for coastal development;
- the opportunity to cooperate with regional and local organizations in developing a comprehensive management and development plan for the coastal zone;
- complementarity/consonance with the development plans and projects of host country agencies, other donors and USAID.

The six participating nations have chosen the following as their project sites:

Brunei Darussalam	entire coastline and the Brunei estuarine system
Indonesia	Segara Anakan-Cilacap
Malaysia	South Johore
Philippines	Lingayen Gulf
Singapore	entire coastline and Southern Islands[1]
Thailand	Ban Don Bay and Phangnga Bay

The six ASEAN members represent immense diversity in biogeographical conditions, sociopolitical systems, culture and economic environments. Such differences made this project rather unique as the ICZM programs developed could be used for developing a typological framework applicable to areas with similar socioeconomic, biogeographical, cultural and political conditions (see Scura et al., this vol.).

ICZM Planning Process. The planning process for the development of the ICZM program followed a general scheme covering a number of essential phases (Fig. 2). The first phase (profiling) included the compilation and analysis of secondary data and reconnaisance surveys and interviews to determine the management issues, community perception of the environment and information gaps. Substantial valuable information was uncovered from mission and consultant reports, published and gray literature as well as raw statistics kept in various central and local government offices. With the exception of Brunei Darussalam where initial field investigations were undertaken, the secondary information from the other countries were adequate to portray a general demographic, economic and ecological profile of the pilot sites. Community and local political leaders, concerned government officials and other stakeholders were interviewed to identify or confirm critical management issues and information gaps. Workshops with various stakeholders were also organized in some countries such as the Philippines, Indonesia and Thailand. The first phase was usually conducted

[1]Initially, Singapore's involvement in this project was limited to two main activities: artificial reefs and cage culture which were not directly relevant to ICZM planning although the research outputs might contribute to technological improvement. However, Singapore in-country activities were subsequently expanded to cover urban coastal management.

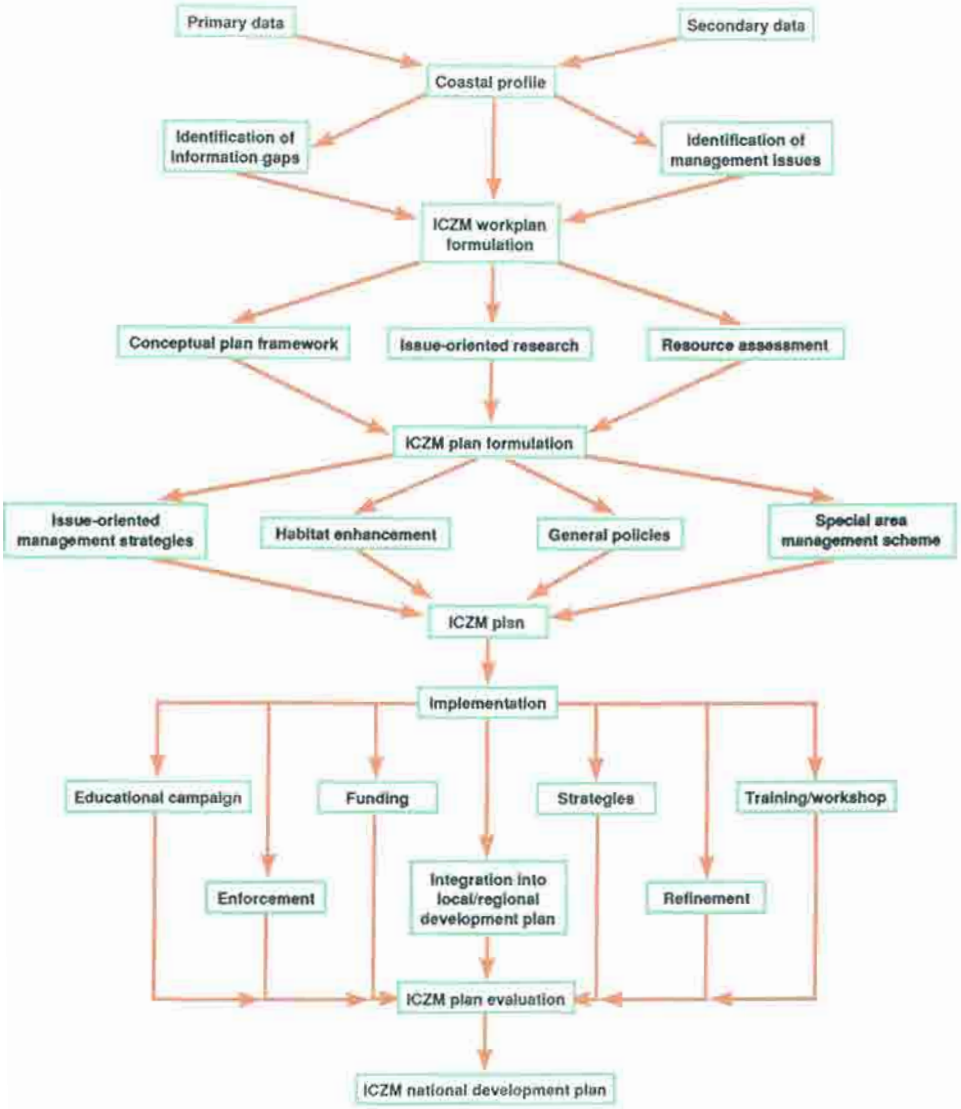

Fig. 2. The process of ICZM plan development.

within six to eight months and the reports were subsequently published (e.g., Chua et al. 1987; Chia and Chou 1988; White et al. 1989; McManus and Chua 1990; ASEAN/US CRMP 1991).

The second phase involved specific issue-oriented research to generate information crucial to management planning and policy reforms. Critical information gaps arising from the lack of databases on the resources, the environment and human activities were translated into research tasks undertaken by various national researchers. A number of multidisciplinary task teams were organized

by the lead implementing or coordinating agency to address the information gaps identified. Most countries had about 20 task teams formed from research organizations, universities, resource governing or managing agencies and in certain situations, consultants were brought in. By the time all in-country projects were in full operation, there were altogether 49 agencies and about 200 researchers and resource managers participating in 120 tasks (Table 1).

The third phase dealt with the synthesis of databases (developed through the collaborative research by all task teams) for formulating resource management

Table 1. Participating organizations of CRMP, 1986-1992.

Brunei Darussalam
- Department of Fisheries
- Department of Forestry
- Department of Town and Country Planning
- Marine Department
- Department of Public Works
- Department of Agriculture
- Brunei Museum
- Universiti Brunei Darussalam

Indonesia
- Indonesian Institute of Sciences
- Directorate General of Fisheries
- Research Institute for Marine Fisheries
- Centre for Oceanological Research and Development
- Centre for Agro-Economic Research
- State Ministry of Population and Environment

Malaysia
- Ministry of Science, Technology and the Environment
- Department of Fisheries
- Ministry of Defence, Hydrography Section
- Department of Agriculture
- Drainage and Irrigation Department
- Department of Town and Country Planning
- Prime Minister's Department, Coordinating and Planning Unit
- Department of Geology
- Department of Survey and Mapping
- Universiti Sains Malaysia
- State Economic Planning Unit (Johore)
- Forest Research Institute
- Pusat Penyelidikan Ternak Air Payau
- National University, Malaysia
- SERES Sdn. Bhd.
- Universiti Teknologi Malaysia

Philippines
- Department of Science and Technology
- Philippine Council for Aquatic and Marine Research and Development
- University of the Philippines Marine Science Institute (UPMSI)
- University of the Philippines College of Social Work and Community Development (UPCSWCD)
- University of the Philippines in the Visayas
- Bureau of Fisheries and Aquatic Resources
- National Economic and Development Authority, Region I

Singapore
- National Science and Technology Board
- Primary Production Department
- Department of Geography, National University of Singapore
- Department of Zoology, National University of Singapore

Thailand
- Office of the National Environment Board, Ministry of Science, Technology and Environment
- Brackishwater Fisheries Division, Department of Fisheries
- Marine Fisheries Division, Department of Fisheries
- Phuket Marine Biological Center, Department of Fisheries
- Royal Forestry Department
- Faculty of Forestry, Kasetsart University
- Department of Marine Science, Chulalongkorn University
- Faculty of Social Sciences and Humanities, Mahidol University

policy, management strategies and action plans. This phase required close interaction between various task teams and the planning team for appropriate technical inputs, verifying and integrating of findings for resource-use conflict resolution, strengthening sectoral management, formulating environmental conservation measures, raising public awareness, involving public consultation, assessing the impacts of plan implementation and finally integrating the ICZM plan into the national development plan.

Throughout the planning process, technical and administrative support were provided by the national coordinating office of the lead implementing or coordinating agency in each country as well as the regional executing and technical agency.

Classification of project activities and task coding. The large number of agencies or organizations involved in the project called for the need to develop an efficient management protocol to keep track of in-country activities. This protocol which included formulation of tasks, research design and mode of operations was clearly defined in the "Guidelines for project implementation and evaluation" (ASEAN/US CRMP 1986). To simplify project management, in-country activities were classified into division, task or subtask and coded accordingly (Fig. 3). Divisions covered coastal profile (Division 100), biogeography (Division 200), socioeconomic (Division 300), legal and institutional studies (Division 400), habitat enhancement (Division 500), ICZM plan/program formulation (Division 600), plan/program implementation (Division 700) and project management (Division 800). Each task comprised one or more activities with measurable objectives and outputs.

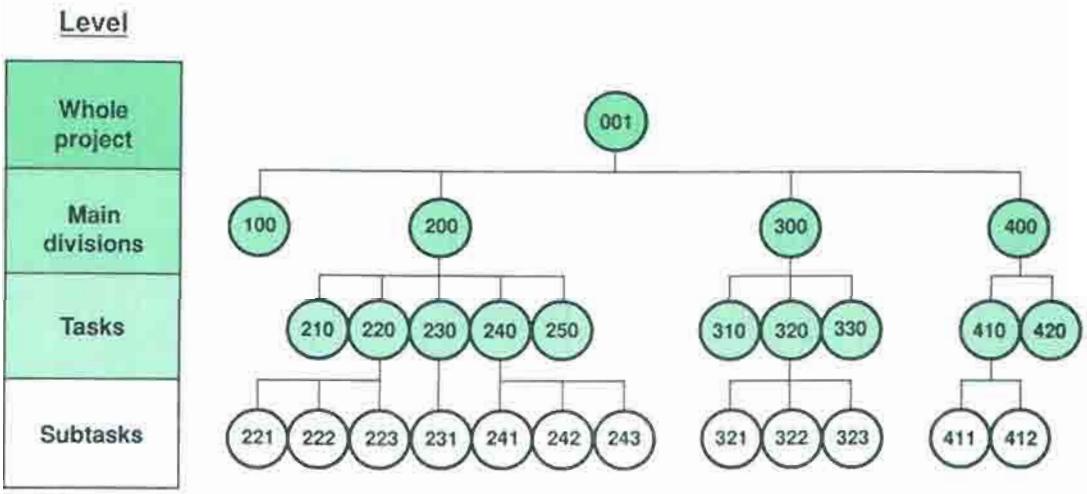

Fig. 3. ASEAN/US CRMP in-country research project coding system.

Box 1. Example of a task proposal undertaking one aspect of biogeographical studies for ICZM in South Johore, Malaysia.

Task Code 250-M: Transport and dispersion of pollutants and dredge residuals.

Targets/products:
1. document, update and compute hydrographic data and flow regimes in Johore Strait under various tidal and meteorological conditions;
2. document, measure and compute the transport and dispersion of pollutants currently being discharged into Johore Strait, and make an environmental impact assessment (EIA) of present and projected discharge loads; and
3. assess the likely impacts of dredge residuals from offshore sand mining along the coast from Tanjung Penawar to Tanjung Sepang, and recommend further study, if deemed necessary.

Description/methodology:
The task has two phases that focus on Johore Strait and offshore sand mining:
Phase I: Secondary and supplementary primary data on hydrography and pollution loading in Johore Strait will be collected. Secondary and additional primary data required in EIA of offshore sand mining will be gathered.
Phase II: Mathematical/computer models of hydrodynamic flow regimes and those which simulate the transport and dispersion of pollutants in Johore Strait will be set up. A tracer dispersion study using Rhodamine B tracer will be designed and implemented. An EIA due to present and projected discharge of pollutants, and a preliminary one for offshore sandmining activities are proposed, coupled with recommendations for further studies.

Duration: One year
Team leader: Dr. Koh Hock Lye (Principal investigator)
Institution involved: Universiti Sains Malaysia

The *biogeographical division* encompassed studies on the natural resource systems and relevant intersystem linkages which characterize the management site such as resource assessment, species-specific management, pollution research and analysis of coastal processes. An example of a task under this division is given in Box 1.

The socioeconomic division included a range of human activities interlinked either directly or indirectly with the natural resource systems. Among these activities were studies examining economic sectors directly supported by these systems; social assessments that identified the underlying causes of human-induced habitat degradation; characterization of key "users" of coastal resources; and resource-use patterns. An example is given in Box 2.

The *legal/institutional division* consisted of all those task activities concerned with the examination of the legal and institutional regime affecting the pilot site.

Box 2. Example of a task on socioeconomic study in South Johore, Malaysia.

Task Code 310-M: Socioeconomic survey

Targets/products:

1. a database quantifying the socioeconomic importance of the coastal resources of South Johore to the state, communities and individuals for basic needs and livelihoods; and
2. a database derived from a reasonable economic determination of (a) the alternative uses of various primary coastal resources (e.g., mangroves) on a sustained basis and (b) the intrinsic value of the preservation of some areas; other coastal resources to be considered are estuaries, beaches, coral reefs and mudflats.

Description/methodology:

The study will describe and document the study area in terms of its economic resource base for human livelihood and sustenance; its human settlements and communities; the socioeconomic activities; and their effects on the natural resource base and communities.

Duration: Eight months, 1988
Team leader: Dr. Wong Poh Kam (Principal investigator)
Institution involved: Department of Town and Country Planning, Socioeconomic Research and Systems Consultants

Primarily, this division covered studies related to definition of the jurisdictional boundaries of the various governmental entities relevant to the pilot site; key coordination points among the local, regional and national organizations; institutional explanations for resource degradation; and nature and extent of institutional databases. An example is given in Box 3.

The *habitat enhancement division* included studies relating to the improvement of degraded habitats or other enhancement measures such as for artificial reefs and marine protected areas.

The *plan formulation division* covered activities relating to synthesis of the databases on biogeographical, socioeconomic and legal/institutional studies which formed the basis for the development of management strategies/actions. A major focus was on the formulation of ICZM plans.

Unlike the above divisions, the *implementation division* was not defined by thematic characteristics but was more operational in nature. Activities were planned on a time frame extending the life of the project and were designed to interact to a high degree with the other components in the development and implementation of the management plan including "consciousness-raising" and building consensus. While some activities focused on the national level, by and large, they emphasized the local level, recognizing plan genesis.

The main function of the *project management division* was to coordinate national activities between tasks and divisions; ensure focus on plan formulation and implementation; reduce duplication of activities; undertake monitoring, evaluating and supervising functions; and forge intertask and interdivision coordination and integration within each in-country project. This division also established linkage with and reported to the regional project management.

Box 3. Example of a task proposal undertaking sociocultural studies in Lingayen Gulf, Philippines.

Task Code 410-P: Cultural context of CRM in Lingayen Gulf

Targets/products:

1. ethnography of coastal communities' perception of marine resources and activities related to their exploitation and use;
2. indigenous methods of CRM;
3. ethnography of village social structure and informal groups and associations which can be harnessed in development programs.

Description/methodology:

The study aims to present a holistic view of life in selected communities along the coast of Lingayen Gulf. It should provide a framework to assess the extent and intensity as well as the importance of CRM and utilization activities of the people in the area. Insights and guidelines for more rational, equitable and humane coastal resource development and management programs should accrue from the study.

Activities under the task are:

1. inventory of coastal resources, the manner of exploiting and utilizing them;
2. mapping out norms, institutions, network or relations relevant to (1);
3. chronicling daily, weekly, monthly, seasonal and annual cycle of activities and events related to CRM as well as alternative occupations; and
4. identification of local groupings, associations (other than village-wide social organizations) and their memberships, goals and functions which can be harnessed for development programs.

The study will make use of these approaches: community survey, census and profile; general and key informant interviews; participant-observation for a year; cognitive mapping; time flow studies; and detailed photo documentation. Ideally, the studies will be done on six selected typical communities at the village level, two from each sector, based on variables such as ecology, technology, population size, exposure to development programs, etc.[2]

Duration: Two years, 1987-1988
Team leader: Prof. Elmer Ferrer
Institution involved: UPCSWCD

[2]Lingayen Gulf and surrounding coastal municipalities were divided geographically into three sectors, each having distinct substrates and topography.

Administration and operation. The various task activities were coordinated and administered by the lead implementing or coordinating agency. The NSC provided national policy guidelines pertaining to the in-country project. The respective responsibilities of PSC, NSC, lead implementing or coordinating agency and the executing and technical agency are given in Boxes 4 and 5.

Human resource development

The project invested substantial resources for manpower development to upgrade national and local capabilities in CRM. Short-term training courses were organized for resource managers, planners and researchers involved in the project to strengthen their knowledge and skills in the application of modern methods and tools for resource assessment and management. The project staff had opportunities to undergo short-term on-the-job special skill training by working with experts in the region or the United States. A few young project staff were selected for long-term academic training in relevant specialized fields on coastal and marine resource management.

Community members involved in participatory research in the Philippines were given special training on data-gathering techniques, particularly on sociocultural information.

Box 4. Project Administration and Operation.

Project Steering Committee

The responsibility for project direction, policies and decisions lies directly with PSC which will report to WGMS-COST. The Philippines has been elected to chair PSC. Under the general category of project policy, PSC s responsibilities will include:

1. providing project direction and guidance;
2. serving as a focal point for project coordination;
3. establishing general operating procedures;
4. sharing project-funded results;
5. reviewing and approving proposed areas for academic training activities;
6. providing means for promoting regional interproject coordination;
7. monitoring, reviewing and evaluating project progress to meet objectives; and
8. approving ICZM country programs and annual workplans.

In addition to the actual PSC members, representatives from ICLARM as executing agency, and USAID as funding agency, will attend committee meetings on an ex-officio basis. Project funds have been allocated for annual meetings with a rotating venue.

Of the 9 short-term and 10 on-the-job training courses conducted, a total of 118 ASEAN nationals participated (Table 2). Towards the end of this project, questionnaires were sent to past trainees to assess the impacts of CRMP training on the use of acquired skills/knowledge in their present job, opportunity for promotion, income increase and other effects on career development. Seventy-seven percent of the trainees responded. The post-training survey found that:

- About 68% were in jobs for which they were trained.
- More than 93% considered their training relevant.
- Almost one-third of the trainees had increased levels of responsibility and received increment in pay.

The survey concluded that the CRMP training activities had met the project objective of building up the technical capability for ICZM in the participating countries (Dalusung 1992).

Strengthening political will and public support

A key element in the successful implementation of ICZM is a strong political will and public support complementing a well-defined program of work in the shift from a sectoral to multisectoral approach.

National Steering Committees

At the national level, each ASEAN member will have an NSC with these responsibilities:

1. preparing and approving annual workplans and project program plans prior to the annual meeting of PSC;
2. establishing country project policy guidelines;
3. screening and selecting candidates for medium-term academic training;
4. selecting participants in the project's various activities;
5. identifying contractors and collaborative institutions to be involved in one or more of the in-country activities;
6. assisting in the preparation and sponsoring of various regional activities;
7. monitoring, reviewing and evaluating in-country project progress; and
8. providing a national focal point for all in-country project activities to interface with PSC.

The coordinating agency of each participating country, which will serve as an NSC member, will be responsible for in-country project activities such as:

1. coordinating with subcontractors (national institutions) in implementing various activities approved by PSC; and
2. administering, disbursing and accounting for funds allocated for the activities.

To ensure successful completion of in-country activities, the coordinating agency may also appoint a national coordinator.

Box 5. Roles and functions of executing and technical agency.

As the executing and technical agency, ICLARM's role is stated in the memorandum of understanding signed in Singapore on 9 May 1986. Specifically, the center's functions will include:

1. disbursing funds in accordance with agreed on workplans, subject to availability of funds from USAID;
2. negotiating contracts for activities to be implemented at both the national and regional levels;
3. periodic monitoring and reviewing of project progress;
4. providing assistance in the preparation of the participating countries' respective annual workplans;
5. developing a project evaluation plan; and
6. preparing and submitting an annual overall project workplan.

In addition to these administrative duties, ICLARM can perform a number of substantive functions related to technical aspects of project implementation:

1. identifying and recruiting short-term technical assistance (on request and approval of the requesting country);
2. preparing and distributing the newsletter;
3. providing in-house technical support from both CRMP staff and non-project ICLARM staff;
4. responding to data requests;
5. facilitating the placement process of candidates selected for on-the-job and medium-term training;
6. facilitating the publication of materials generated from various countries and regionally specific project-related activities;
7. assisting in the preparation and conducting of regional workshops, seminars and training activities;
8. assisting in the establishment of the cooperative research network under Project Component 1; and
9. assisting in enhancing public awareness on CRM, including the development of educational and promotional materials.

Towards this objective, the project organized policy conferences and workshops participated in by policymakers, resource managers and administrators of various resource planning and governing agencies at central and local levels, community leaders, and members of media and nongovernment organizations (NGOs). Three such conferences were held at Johore Bahru (Malaysia), Baguio (Philippines) and Singapore. These resulted in the adoption of the "Baguio resolution on coastal resources management" (see Chua and Scura 1991) and the "Singapore resolution on waste management in the coastal areas of the ASEAN region" (see Chua and Garces 1992). Such meetings reinforced efforts for national commitments to the application of ICZM.

To promote public awareness on the deterioration of the environment and the resource base, the project published educational materials for wide circulation in

Table 2. Training activities of ASEAN/US CRMP, 1986-1991.

Training title	Date	Venue
A. Short-term training		
1. Information Research and Management	29 Sep-13 Oct 1986	Manila, Philippines
2. Regional Training Course in the Application of Remote Sensing to Coastal Zone Planning and Management	12-28 Oct 1986	Manila, Philippines
3. Principles of Coastal Resources Management (First Session)	1-14 Mar 1987	Phuket, Thailand
4. Principles of Coastal Resources Management (Second Session)	9-21 Jun 1987	Johore, Malaysia
5. Methods for Socioeconomic Analysis in Coastal Area Management	3-15 Nov 1987	Singapore
6. Principles of Coastal Resources Management (Third Session)	3-16 Apr 1988	Jakarta and Cilacap, Indonesia
7. Training Course on Remote Sensing and Geographic Information Systems Application to Coastal Resources Assessment and Planning	1-12 Nov 1988	Singapore
8. Principles of Economic Valuation of Coastal Resources	7-19 May 1990	DAP, Tagaytay City, Philippines
9. Training Course on Remote Sensing and Geographic Information Systems for Coastal Zone Management and Planning	4-14 Dec 1990	ICLARM and NAMRIA, Philippines
B. On-the-job training		
1. On-site Management of Marine Protected Areas	27 Jul-26 Aug 1987	Miami, Florida, USA
2. International Tropical Fisheries Conference	17-23 Oct 1987	UPMSI, Philippines
3. Identification of Coral Reef Fishes in the Reef Habitat	20 Feb-20 Mar 1988	Batangas and Manila, Philippines
4. Second International Seminar on Coastal Parks and Protected Areas	14 May-3 Jun 1989	Florida, USA and Yucatan, Mexico
5. Coastal Habitat Management with Emphasis on Mangroves	3-28 Jul 1989	Dumaguete City, Philippines
6. Coastal Policy and Processes Training Program	16 Jul-12 Aug 1989	USC; Costa Rica, Central America
7. Coastal Habitat/Mangrove and Coral Reef Resources Management	7 Apr-5 May 1990	SU, Dumaguete City, Philippines
8. Artificial Reef Assessment/Monitoring	23 Sep-23 Oct 1990	Singapore
9. Fish Stock Assessment	5 Nov-4 Dec 1990	Manila, Philippines
10. Coastal Resources Habitat/Mangrove Resources Management	7 Nov-4 Dec 1990	SU, Dumaguete City, Philippines
C. Medium-term academic training		
1. Master in Marine Affairs (M.M.A.)	Sep 87-May 1988	URI, USA
2. Master in Marine Affairs (M.M.A. thesis)	Sep 87-Oct 1989	UW, USA
3. Master in Arts in Economics (M.A. Eco.)	Sep 87-May 1989	NUB, USA
4. Master of Science in Microbiology	Sep 89-May 1991	FSU, Tallahassee, Florida
5. Master of Science in Marine Affairs (M.S.M.A.)	Sep 90-May 1991	URI, USA

DAP - Development Academy of the Philippines
FSU - Florida State University
NAMRIA - National Mapping Research and Information Authority
NUB - Northeastern University of Boston
SU - Silliman University
URI - University of Rhode Island
USC - University of South Carolina
UW - University of Washington

Source: Dalusung (1992).

participating nations. The education series ranged from issue-oriented comics and posters to informational materials for school children, teachers and the common citizens. Issues on coastal resource depletion, environmental degradation and conflicts arising from competitive use of scarce resources were highlighted in local media. These efforts contributed to the general increase of public concern for the environment and a greater commitment of political will from almost all countries in the ASEAN region.

Promoting organizational networking and information exchange

The 49 organizations participating in the project were linked and collectively undertook research, training and information exchange activities related to ICZM. The project served as the focal point for regional collaboration and cooperation. Its newsletter, *Tropical Coastal Area Management*, was primarily produced as a source of information on ICZM activities undertaken in the region as well as in other parts of the world. The newsletter also contributed significantly to the dissemination of concepts, experiences and methods used for tropical ICZM to more than 97 nations. The project published a number of technical reports, conference/workshop proceedings, educational materials and the management plans of the six countries (see Box 6). These publications were distributed to members of the project and major libraries in the world.

The participating organizations of CRMP and the core of researchers, resource managers and planners established the organizational and individual linkages which enabled the region to take on a leading role in ICZM. A directory published by the project lists more than 90% of the key organizations and researchers on coastal and marine sciences in ASEAN and therefore serves as a useful reference.

Project Management

Developing ICZM programs in the six ASEAN members, all of which had little previous experience in it, was a very difficult task indeed. The ICZM approach was new to the region and no appropriate typology from other nations could be applied to its diverse ecological, socioeconomic, political and cultural conditions. A regional project of such complexity needed a proper management protocol that could facilitate smooth execution of in-country task activities, and enable the project management to monitor the progress of each task and provide the necessary technical and administrative support.

The CRMP was fortunate to have been able to discharge its functions and ensure timely completion of its workplans. Several elements contributed to this.

Box 6. CRMP publications (1986-1992).

CONFERENCE PROCEEDINGS (Conf. Proc.)

Silvestre, G., E. Miclat and T.-E. Chua, editors. 1989. **Towards sustainable development of the coastal resources of Lingayen Gulf, Philippines.** ICLARM Conf. Proc. 17, 200 p. (CRMP Conf. Proc. 1).

Chua, T.-E. and D. Pauly, editors. 1989. **Coastal area management in Southeast Asia: policies, management strategies and case studies.** ICLARM Conf. Proc. 19, 254 p. (CRMP Conf. Proc. 2).

Chua, T.-E. and A.T. White, editors. 1989. **Policy recommendations for coastal area management in the ASEAN region.** ICLARM Conf. Proc. 20, 10 p. (CRMP Conf. Proc. 3).

Chou, L.M., T.-E. Chua, H.W. Khoo, P.E. Lim, J.N. Paw, G.T. Silvestre, M.J. Valencia, A.T. White and P.K. Wong, editors. 1991. **Towards an integrated management of tropical coastal resources.** ICLARM Conf. Proc. 22, 455 p. (CRMP Conf. Proc. 4).

The Policy Conference on Managing ASEAN's Coastal Resources for Sustainable Development. 1990. **Baguio resolution on coastal resources management.** ICLARM Conf. Proc. 23, 11 p. (CRMP Conf. Proc. 5).

Chua, T.-E. and L.F. Scura, editors. 1991. **Managing ASEAN's coastal resources for sustainable development: roles of policymakers, scientists, donors, media and communities.** ICLARM Conf. Proc. 30, 125 p. (CRMP Conf. Proc. 6).

Chia, L.S. and L.M. Chou, editors. 1991. **Urban coastal area management: the experience of Singapore.** ICLARM Conf. Proc. 25, 128 p. (CRMP Conf. Proc. 7).

Chua, T.-E., editor. 1991. **Coastal area management education in the ASEAN region.** ICLARM Conf. Proc. 29, 92 p. (CRMP Conf. Proc. 8).

The Conference on Waste Management in the Coastal Areas of the ASEAN Region. 1991. **Singapore resolution on waste management in the coastal areas of the ASEAN region.** ICLARM Conf. Proc. 32, 12 p. (CRMP Conf. Proc. 9).

Chua, T.-E. and L.R. Garces, editors. 1992. **Waste management in the coastal areas of the ASEAN region: roles of policymakers, scientists, donors, media and communities.** ICLARM Conf. Proc. 33, 218 p. (CRMP Conf. Proc. 10).

Silvestre, G., H.J.H. Matdanan, P.H.Y. Sharifuddin, M.W.R.N. De Silva and T.-E. Chua, editors. 1992. **The coastal resources of Brunei Darussalam: status, utilization and management.** ICLARM Conf. Proc. 34, 214 p. (CRMP Conf. Proc. 11).

Continued

Comprised of senior officials from the ASEAN region, PSC provided the necessary project direction, policy guidelines and strong support to the Project Management Office at ICLARM. Right from the beginning, PSC members played an important role in project coordination, established operating procedures, and reviewed and approved annual workplans. More important were the project coordinator's day-to-day administering and managing in-country projects and tasks as well as activities in training and information dissemination. Acceptabil-

Box 6. (continued)

Conf. Proc. (cont'd)

Chua, T.-E. and L.F. Scura, editors. 1992. **Integrative framework and methods for coastal area management.** ICLARM Conf. Proc. 37, 169 p. (CRMP Conf. Proc. 12).

TECHNICAL REPORTS (Tech. Rep.)

Chua, T.-E., L.M. Chou and M.S.M. Sadorra, editors. 1987. **The coastal environmental profile of Brunei Darussalam: resource assessment and management issues.** ICLARM Tech. Rep. 18, 193 p. (CRMP Tech. Rep. 1).

Paw, J.N., S. Bunpapong, A.T. White and M.S.M. Sadorra, editors. 1988. **The coastal environmental profile of Ban Don Bay and Phangnga Bay, Thailand.** ICLARM Tech. Rep. 20, 78 p. (CRMP Tech. Rep. 2).

Chia, L.S., H. Khan and L.M. Chou. 1988. **The coastal environmental profile of Singapore.** ICLARM Tech. Rep. 21, 92 p. (CRMP Tech. Rep. 3).

White, A.T., P. Martosubroto and M.S.M. Sadorra, editors. 1989. **The coastal environmental profile of Segara Anakan-Cilacap, South Java, Indonesia.** ICLARM Tech. Rep. 25, 82 p. (CRMP Tech. Rep. 4).

McManus, L.T. and T.-E. Chua, editors. 1990. **The coastal environmental profile of Lingayen Gulf, Philippines.** ICLARM Tech. Rep. 22, 69 p. (CRMP Tech. Rep. 5).

ASEAN/US CRMP. 1991. **The coastal environmental profile of South Johore, Malaysia.** ICLARM Tech. Rep. 24, 65 p. (CRMP Tech. Rep. 6).

Department of Fisheries, Ministry of Industry and Primary Resources, Brunei Darussalam. **The integrated management plan for the coastal zone of Brunei Darussalam.** ICLARM Tech. Rep. 29, 122 p. (CRMP Tech. Rep. 7).

Office of the National Environment Board-Ministry of Science, Technology and Environment, Thailand. **The integrated management plan for Ban Don Bay and Phangnga Bay, Thailand.** ICLARM Tech. Rep. 30, 161 p. (CRMP Tech. Rep. 8).

Chia, L.S. **Singapore's urban coastal area: strategies for management.** ICLARM Tech. Rep. 31, 99 p. (CRMP Tech. Rep. 9).

National Economic Development Authority, Region I, Philippines. **The Lingayen Gulf coastal area management plan.** ICLARM Tech. Rep. 32, 87 p. (CRMP Tech. Rep. 10).

Malaysian Coastal Resources Study Team, Ministry of Science, Technology and the Environment, Malaysia. **The coastal resources management plan for South Johore, Malaysia.** ICLARM Tech. Rep. 33, 291 p. (CRMP Tech. Rep. 11).

ASEAN/US CRMP, Directorate General of Fisheries, Indonesia. **The integrated management plan for Segara Anakan-Cilacap, Central Java, Indonesia.** ICLARM Tech. Rep. 34, 100 p. (CRMP Tech. Rep. 12).

Continued

Box 6. (continued)

EDUCATION SERIES (Educ. Ser.)

White, A.T. 1987. **Coral reefs: valuable resources of Southeast Asia.** ICLARM Educ. Ser. 1, 36 p. (CRMP Educ. Ser. 1).

White, A.T. 1988. **Marine parks and reserves: management for coastal environments in Southeast Asia.** ICLARM Educ. Ser. 2, 36 p. (CRMP Educ. Ser. 2).

ASEAN/US CRMP in cooperation with Asian Wetland Bureau and WWF Malaysia. 1988. **"Mangroves must live"** poster. ICLARM Pos. 2. (CRMP Educ. Ser. 3).

Cabrera, L.M. 1988. ***May pangako mula sa dagat*** (comics on blast fishing, in Pilipino). ICLARM Educ. Ser. 3, 26 p. (CRMP Educ. Ser. 4).

There is still hope/*May pag-asa pa* (comics on marine parks). 1989. ICLARM Educ. Ser. 4, 14 p. (CRMP Educ. Ser. 5).

Fortes, M.D. 1989. **Seagrasses: a resource unknown in the ASEAN region.** ICLARM Educ. Ser. 5, 47 p. (CRMP Educ. Ser. 6).

White, A.T., L.M. Chou, M.W.R.N. De Silva and F.Y. Guarin. 1990. **Artificial reefs for marine habitat enhancement in Southeast Asia.** ICLARM Educ. Ser. 11, 45 p. (CRMP Educ. Ser. 7).

Wong, P.P. 1991. **Coastal tourism in Southeast Asia.** ICLARM Educ. Ser. 13, 40 p. (CRMP Educ. Ser. 8).

Continued

ity of and trust given to the project coordinator by PSC, the donor and the various lead implementing or coordinating organizations were critical. The fact that the project was executed and managed by ASEAN nationals contributed to a strong regional cooperation.

Competent technical and support staff at ICLARM provided timely, efficient assistance to the in-country activities.

Impacts

The CRMP was generally acknowledged by ASEAN and the donor agency to be successful as reflected by the annual evaluation of project performance by PSC and external reviews conducted by the donor. The achievements of CRMP and its impacts are outlined below.

1. The ASEAN has developed a pool of resource persons and a network of organizations with the knowledge and experience in ICZM to assist national governments within or outside the region to undertake the program. The ASEAN can therefore play a leading role in Agenda 21 of the

Box 6. (continued)

STUDIES AND REVIEWS (Stud. Rev.)

McManus, J.W., C.L. Nañola, Jr., R.B. Reyes, Jr. and K.N. Kesner. **Resource ecology of the Bolinao coral reef system.** ICLARM Stud. Rev. 22, 117 p. (CRMP Stud. Rev. 1).

DIRECTORY (Dir.)

Chua, T.-E., M.A.A. Agulto, F.Y. Guarin and S.C. Guerrero, compilers. 1989. **Directory of institutions and scientists in the ASEAN region involved in research and/or management related to coastal areas.** 373 p. (CRMP Dir. 1).

NEWSLETTER

Tropical Coastal Area Management. Triannual, 1986-1991.

United Nations Conference on Environment and Development (see Scura et al., this vol.).

2. The knowledge and experience acquired through CRMP shaped an ICZM typological framework applicable to other developing nations. The lessons learned helped formulate the "Technical guidelines for the application of ICZM in developing nations," jointly sponsored by the World Bank, United Nations Environment Programme, and Food and Agriculture Organization.
3. The CRMP has "sensitized" policymakers in ASEAN on the importance of sustainable coastal area management that has contributed to a greater commitment of political will and national resources to ICZM in almost all countries in the region. For example, the Thai national government has appropriated financial resources for the formulation of coastal policies and implementation of ICZM programs.
4. The ICZM plans have been integrated, fully or partly, into the national or local economic development plans of Brunei Darussalam, the Philippines, Indonesia, Malaysia and Thailand.
5. The CRMP has made substantial documentation on the environment and development of the coastal areas. The information generated makes useful databases that could be enriched for future planning and management of the coastal resources.

Conclusion

Going through the initiation, implementation and conclusion of a project of such magnitude and complexity was indeed a great experience for the CRMP regional and national staff. During the course of project implementation, a host of problems had to be resolved. Some of them were trivial administrative matters, others were technical difficulties related to methodologies but more serious were organizational problems such as those arising from choice of sites and appointment of lead or coordinating agencies. Despite the frustrations experienced by the CRMP staff that required tremendous patience, tolerance and understanding to overcome, good teamwork pushed the project through successfully.

The importance given to CRMP by the participating countries was best manifested by the substantial national contributions to it. Almost all the ASEAN members gave nearly as much as the donor; two countries even exceeded their share (Table 3). The policy workshops also played a part, but it was the involvement of the large number of researchers, planners, policymakers, community leaders, resource managers, media and NGOs from each country that made the national contributions worthwhile.

Table 3. ASEAN/US CRMP: country counterpart contributions (in US$).

	Brunei Darussalam	Indonesia	Malaysia	Philippines	Singapore	Thailand	Total
1986				12,400.00	14,000.00	12,115.00	
1987	66,705.00		246,933.00	125,824.00	177,500.00	73,771.00	
1988	47,941.84		18,769.00	162,112.00	165,000.00	77,574.00	
1989	94,507.83			40,707.00	170,000.00	91,486.00	
1990	119,495.00		85,500.00	22,612.00	170,000.00	62,662.00	
1991	57,856.00			8,630.00	61,000.00	36,068.00	
1992	18,818.00			1,500.00			
Total contribution	405,323.67	319,512.00	351,202.00	373,785.00	757,500.00	353,676.00	2,560,998.60
%[a]	123.27	66.56	87.80	78.69	173.46	70.74	
Total allocation	328,814.00	480,000.00	400,000.00	475,000.00	436,710.00	500,000.00	2,620,524.00

[a] $\frac{\text{Total contribution}}{\text{Total allocation}}$

Acknowledgments

This project would not have been successful without the support and cooperation of PSC members, especially the chairman, Dr. Rafael D. Guerrero III. The chairman of the ASEAN Subcommittee on Marine Science, Dr. Aprilani Soegiarto, gave valuable advice. The significant contributions of the national

coordinators and lead implementing or coordinating agencies of all participating countries, and the collaboration of various organizations are greatly appreciated. Dr. Random Dubois, Dr. Alan T. White, Dr. Heng L. Thung and Dr. Louise Fallon Scura provided technical guidance.

The commitment, hard work and loyalty of the entire project staff at ICLARM deserve congratulations, particularly Mr. James N. Paw, Ms. Marie Sol M. Sadorra, Ms. Rachel C. Josue and Ms. Rachel C. Atanacio. Finally, credit is due Ms. Cory C. Guerrero for her support and understanding throughout the course of the project.

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ASEAN/US CRMP (Association of Southeast Asian Nations/United States Coastal Resources Management Project). 1991. The coastal environmental profile of South Johore, Malaysia. ICLARM Tech. Rep. 24, 65 p.

Chia, L.S. and L.M. Chou. 1988. The coastal environmental profile of Singapore. ICLARM Tech. Rep. 21, 92 p.

Chua, T.-E., L.M. Chou and M.S.M. Sadorra, editors. 1987. The coastal environmental profile of Brunei Darussalam: resource assessment and management issues. ICLARM Tech. Rep. 18, 193 p.

Chua, T.-E. and L.F. Scura, editors. 1991. Managing ASEAN's coastal resources for sustainable development: roles of policymakers, scientists, donors, media and communities. ICLARM Conf. Proc. 30, 125 p.

Chua, T.-E. and L.R. Garces, editors. 1992. Waste management in the coastal areas of the ASEAN region: roles of governments, banking institutions, donor agencies, private sector and communities. ICLARM Conf. Proc. 33, 218 p.

Dalusung, M.L. 1992. Post-training survey report of the ASEAN/US coastal resource management project. Trop. Coast. Area Manage. 6(3):34-36.

McManus, L.T. and T.-E. Chua, editors. 1990. The coastal environmental profile of Lingayen Gulf, Philippines. ICLARM Tech. Rep. 22, 69 p.

White, A.T., P. Martosubroto and M.S.M. Sadorra, editors. 1989. The coastal environmental profile of Segara Anakan-Cilacap, South Java, Indonesia. ICLARM Tech. Rep. 25, 82 p.

Legal and Organizational Considerations in the Management of Coastal Areas

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TOBIN, R.J. 1992. Legal and organizational considerations in the management of coastal areas, p. 93-105. *In* T.-E. Chua and L.F. Scura (eds.) Integrative framework and methods for coastal area management. ICLARM Conf. Proc. 37, 169 p.

Abstract

The cause of problems associated with coastal resources can be traced to deficiencies in the organizations responsible for their management. Common behavioral patterns among government institutions in Southeast Asia emerge from the identification of some characteristics of coastal resources as an organizational issue. Examination of prevailing institutional arrangements and legal considerations will lead to a better understanding of how organizations must operate to successfully implement desired goals.

Few areas of the world are as dependent on their coastal resources as are the nations of Southeast Asia. The coastal areas of the six Association of Southeast Asian Nations (ASEAN) states, the adjacent waters and their marine life sustain millions of people. One recent estimate suggests that, of the approximately 300 million people who live in these six countries, as many as three quarters are in

coastal areas. Furthermore, of all the animal protein consumed by the region's people, 60% is derived from the sea (Yong 1989).

The region's dependence on coastal resources is not limited to food. Attractive beaches create opportunities for tourism; coral reefs and seagrass beds provide recreational potential, protect coastlines from erosion and sustain habitats for scores of marine species. Productive mangroves offer forestry products, sustain the ecological balance of estuaries and provide valuable sites for aquaculture. Offshore drilling for petroleum is vital to several of the nations' economies. This limited, but far from complete overview of coastal resources well indicates the region's inextricable link to the care and fate of these coastal areas.

Unfortunately, as is frequently the case elsewhere as populations swell and as aspirations for economic growth remain strong, pressures to overexploit coastal resources intensify. Too many people are placing unrealistic demands on these resources, and the results are readily evident--deteriorating water quality, coastal erosion, loss of mangroves, decreasing biological diversity, destruction of coral reefs, water polluted by untreated sewage and, occasionally, disastrous oil spills. All of these problems cause a decline in the productivity of coastal resources. As an example, in the Gulf of Thailand in the early 1960s, only a few hundred trawlers could be counted and the catch rate was about 300 kg/hour. Two decades later, as the number of far more efficient trawlers had increased dramatically, the catch rate had declined to 50 kg/hour (Panayotou and Jetanavanich 1987). Filipino fishers have experienced a similar slump, and Pauly (1989) reports that a "clear pattern of overcapitalization and overfishing has emerged....Effort in the fisheries sector as a whole is two to three times in excess of optimum exploitation rates."

As catches diminish, conflicts over the resource base inevitably increase as small-scale fishers find that they must compete with commercial trawlers from distant ports. Rather than do so, some fishers turn to the illegal and environmentally harmful practice of blast fishing. Others avoid the risk of explosions and rely instead on cyanide or other poisons to kill fish. As the per capita availability of marine resources dwindles, the incentives to use illegal or other environmentally harmful practices rise dramatically when socially accepted management systems are not in place. In short, if Southeast Asia's coastal resources are to remain a continuing source of economic sustenance, they must be managed such that present patterns of exploitation and consumption do not jeopardize either their current or future productivity.

Identifying the Challenges

One of the challenges in addressing these coastal problems is to identify the causes for their existence and persistence. The last two decades have witnessed an explosion of interest in environmental issues and a concurrent recognition

that prevailing patterns of use and exploitation of natural resources are typically unsustainable. The single best expression of this view is well explored in *Our common future*, a report of the World Commission on Environment and Development (WCED 1987).

Despite increased levels of knowledge, awareness and concern about the management of environmental and coastal resources, it is hardly difficult to identify growing numbers of coastal areas that require immediate attention and rehabilitation. Where lies the problem? Few scientists are content with the state of knowledge regarding coastal ecosystems. Nonetheless, a convincing case can be made that we know enough about the effects of pollution and environmental degradation on fishes, coral reefs and mangrove forests to justify appropriate remedial action. Likewise, engineers have successfully addressed most of the problems associated with technological deficiencies. Most of the technology--some quite simple--necessary to deal with the pollution or other insults to coastal resources is similarly available, although not always economically feasible.

Having dismissed lack of knowledge of biological and physical relationships and inadequate technology as explanations for continued misuse of coastal resources, it is similarly possible to disregard limited financial resources as a reason. While it is true that poverty pervades much of the world, it is a rare government that is not able to find money for its preferred projects. Political will usually produces political capital, which readily converts to spendable resources.

Not all possible explanations for the current state of coastal resources have been exhausted. To the extent that environmental problems arise and continue, the explanation can be found in deficiencies in the organizations we rely on to deal with these problems (Stone 1975). Accepting this argument does not mean we can ignore or dismiss claims for more science, technology and resources, but it does suggest the desirability and appropriateness of increased attention to the legal and political institutions responsible for coastal resources. Indeed, if institutional patterns serve as key explanatory variables, then knowledge of these variables can only enhance efforts to achieve both effective coastal resources management (CRM) as well as their sustained use.

Coastal Resources Management as an Organizational Issue

The six members of ASEAN are politically, socially and economically diverse, but this need not discourage the search for common patterns among the nations. A large body of scholarship suggests that political and governmental organizations--as bureaucracies--have much in common regardless of geographic location. Accordingly, if organizational features explain the existence and continuance of problems with CRM and if bureaucracies have similar characteristics, then the more we know about the behavior of these organizations, the greater the prospects for addressing these problems successfully.

All governmental organizations have an identifiable culture that Wilson (1989) defines as "a persistent, patterned way of thinking about the central tasks of and human relationships within an organization." He adds that "culture is to an organization what personality is to an individual." The typical organizational culture includes preferences for survival and members' well-being. Similarly, all organizations have one or more tasks or missions. It is almost axiomatic that organizations prefer that their missions be blessed with popular approval.

The notion of organizational mission provides a useful framework. Organizations both react to and attempt to affect their environment. Consequently, examining some of the relevant characteristics of coastal resources as an organizational issue will help explain the behavior of the organizations responsible for these resources. A considerable number of characteristics can be identified that seem most relevant to the ASEAN context.

Coastal resources management as a new issue

It is a rare policymaker that has too little to do. Unable to control the number of demands on his time or supplicants seeking immediate attention, the typical policymaker finds that his agenda has enough items on it to occupy most of his energy and all of his time (or all of his energy and most of his time). To cope with these unceasing demands, his normal response is to deal with the familiar, that is, with items with which he has some experience and expertise. Rather than having to learn anew, he finds that his familiarity with a topic eases the decisionmaking processes, allows dependence on current formulas (or, at best, slight variations of these), and retains the favor of the beneficiaries of the status quo, namely those groups who prefer that the item receive attention.

The point to be made is that efforts to redirect a policymaker's attention are fraught with difficulties. Not only are policymakers already overburdened, but also pressured to keep their agenda relatively unchanged. Regardless of the merits of an issue--such as wise and sustainable use of coastal resources--few policymakers are naturally inclined to seek new items for their agenda. For every new issue they place on their agenda, some other issue must be neglected or removed. Moreover, even when policymakers are readily amenable to a new item on their agenda, they must still cope with significant matters they cannot ignore. At the national level, these include defense, foreign relations, international trade, budgets, revenues, tax codes and normally, programs focusing on health, education, welfare and agriculture. In short, issues related to CRM compete with scores of other, more familiar ones that claim both categorical precedence and policymakers' attention.

The consequences of these agenda-setting strategies on improved CRM in Southeast Asia are clear. A major purpose of the ASEAN/US Coastal Resources Management Project (CRMP) has been to increase awareness of the problems

associated with the region's coastal resources. There is considerable evidence that this goal has been achieved. Nonetheless, the identification of a *condition*, such as a deteriorating base of coastal resources, is not the same as the definition of a *problem* that requires attention and response. As one observer (Kingdon 1984) notes, "Conditions become defined as problems when we come to believe that we should do something about them."

Unfortunately, even when the translation from condition to problem occurs, there is little urgency to do something about "problems" when people are able to live with the consequences. This may explain much of the world's apparent indifference to global warming and the accelerating loss of biological diversity. More to the point, millions of people in Southeast Asia have been living with the effects of deteriorating coastal resources for generations without evident distress. Only in the last decade or two have the people come to realize that their coastal resources are no longer able to withstand increasing demands. Thailand's Ban Don Bay and the Philippines' Lingayen Gulf probably provide the best regional examples; conditions, once tolerable, are now widely perceived to be problems and are forcing issues associated with CRM onto political and organizational agenda.

Integrated coastal resources management is holistic

It is generally recognized that the environment is best "managed" from a holistic perspective in which all its parts are assumed to be interdependent. Similarly, sound use of coastal resources is inherently holistic in that it considers myriad ecological interrelationships involving land, air and water. In this regard, CRM is far more demanding than the management of air or water pollution. Like these issues, however, destruction of coastal environments respects neither political nor organizational boundaries.

These traits have important implications in terms of how government institutions are likely to respond to CRM issues. First, no government currently addresses environmental problems in a holistic perspective. It is unreasonable to expect governments to do so, however compelling the need or desirability. Administrative jurisdictions are typically narrow in range, and bureaucracies are highly protective of their core responsibilities. A holistic viewpoint would conflict with these traits because such a perspective requires broad and far-reaching jurisdictional responsibilities as well as infringement on the most sacred of bureaucratic jurisdictions--what might be called the heartland. This is alien territory to all other organizations (Downs 1966). Bureaucracies are extraordinarily sensitive to transgressions of their boundaries and often react to proposals for change only after considering how the proposal will affect their territorial jurisdictions. As Downs (1966) observes, "such territorial vigilance is highly rational." He adds, however, that excessive "territorial sensitivity makes any changes in

bureaucratic behavior more difficult–and therefore more costly–than they would be if such sensitivity were optimal."

The Philippines' experience with CRMP provides a relevant example of Downs' point. The key participants in the planning process in the Lingayen Gulf agreed that existing organizational arrangements for the management of the gulf's resources are inadequate. Beyond that, however, there was much less consensus about what should be done to remedy the problem. Some of the participants suggested the creation of a regional coordinating body with comprehensive regulatory authority. Others just as readily rejected the idea of a new authority in favor of reliance on existing organizations. The relevant provincial governors opposed the idea, no doubt because it would diminish their influence and authority. As might be expected, they preferred that responsibility for management of the gulf's resources be given to the provincial governments. When the governors' idea was presented to several mayors, they opposed it because such centralization would supposedly lessen their authority and provincial governments are not organized properly to handle the task, or so it was argued.

Second, while cooperation among different organizations is possible (but not likely), effective collaboration is premised on agreement on overall goals. Such agreement is rare, even among like-minded organizations and those with related tasks. Unlike private firms seeking profits, government institutions are far more likely to have general, ambiguous and inconsistent goals that discourage agreement (Banfield 1985). Equally important, coordination and cooperation also require the establishment and maintenance of communications among organizations, the handling of disputes among them and effective oversight (Fenno 1959).

These requirements are difficult to initiate and achieve under the best of circumstances. As an illustration, the settlement of disputes between two ministries places the chief executive in a quandary. The disagreement itself reveals conflict within his administration, and a decision in favor of one agency serves to undermine the credibility of the other. In addition, in those cases when outright disagreement can be avoided, ministries or agencies usually have few if any sanctions that can be applied to sister agencies that violate environmental regulations.

In the American setting, substantial proof suggests that gaining compliance with environmental requirements from private industry is far easier than that from other government departments (Durant 1985; Wilson and Richardson 1985). Much of the explanation is related to the points noted above, namely, the disincentives for political executives to become involved in dispute resolution and the lack of effective incentives for compliance or sanctions for noncompliance. When public agencies do conform with statutory mandates or requests from environmental agencies, the cooperation is gained only after negotiation and bargaining and at the cost of adaptation and compromise.

Although these lessons are from the experience of nations outside of Southeast Asia, considerable evidence from the region implies the lessons' applicability to

the management of its coastal resources. In their study of institutional arrangements for CRM in Thailand's Ban Don Bay, for example, Panvisavas et al. (1991) observe that implementation of management plans is difficult because of coordination problems among agencies. Even with a highly centralized government, a national development plan that recognizes the rampant exploitation of natural resources, and a shared realization that tourism ought to be promoted in a sustainable manner, key agencies have not been able to agree on what should be done to protect tourism-related coastal resources.

A similar situation can be found in Malaysia. In discussing governmental responsibilities, *The coastal environmental profile of South Johore, Malaysia* (ASEAN/US CRMP 1991) cites the disagreement among organizations about their roles in the event of an oil spill. Here there is no question about agreement over goals. As the report concludes, however, bound by "institutional constraints and differing policies and hampered by the ambiguities of overlapping functions, the activities of institutions can come into direct conflict." Such a situation is not at all unusual, and provides evidence for an important point. Whereas agreement on goals is essential, it does not necessarily ensure interorganizational collaboration to achieve or implement these goals (Pressman and Wildavsky 1973).

Third, to the extent that effective CRM requires changes in what governments do, standard operating procedures (SOPs) determine much of what bureaucracies do. These SOPs simplify organizational decisionmaking processes, maintain consistency, and allow the application of common rules to similar situations or problems. The difficulty with SOPs is that they too often govern rather than guide bureaucrats, and this tendency contributes to conservatism, reluctance to change existing patterns, and reliance on precedents. Kaufman (1971) aptly explains these preferences: "Precedent serves as a valuable guide because it clearly defines the safe path; in a minefield, wise men step exactly in the footprints of predecessors who have successfully traversed the hazardous area."

To their detriment, advocates of different paths through the bureaucratic minefield must confront prevailing norms of behavior in the form of SOPs. Improved CRM clearly requires significant change in existing patterns of use and exploitation in Southeast Asia, but calls for such change will face inertia and resistance in the guise of rational bureaucratic behavior. In fact, calling for major changes in CRM may be counterproductive. As Allison (1971) tells us: "Projects that demand that existing organization units depart from their established programs to perform unprogrammed tasks are rarely accomplished in their designed form."

The burden of proof is likewise on the shoulders of those who want to change the status quo. After all, there are many beneficiaries of the status quo, whether they be sand miners, owners and operators of commercial trawlers and beach resorts, or fishers who rely on poisons or dynamite to enhance their catch. All these people contribute to employment and economic growth, and these are highly preferred values in all societies.

Threats to these values are sure to provoke a strong and unpleasant response. The beneficiaries of the status quo know who they are, and have a powerful economic incentive to organize politically. In contrast, the potential beneficiaries of improved CRM (or more generally, the potential recipients of a collective benefit) have little incentive to organize. As Olson (1968) so cogently explains, in the absence of coercion, people will not act to advance their common objectives, including improved environmental quality, "even when there is unanimous agreement in a group about the common good and the methods of achieving it."

Despite the constraints, organizations do change, albeit gradually. When change does occur, its impetus is likely to be from outside the organization in the form of new recruits, externally imposed reorganizations, through enhancement of responsibilities, or because of major events in the environment (Kaufman 1971). Although reorganization is often suggested as a solution to inadequate CRM, such action is often an inappropriate antidote (Tobin 1989). The obstacles to success notwithstanding, bureaucratic change is most likely to be found in large rather than small organizations. Not only is size related to internal diversity, but also a predictor of relative wealth. Wealthy organizations are able to support innovative experiments and demonstration projects (Kaufman 1971).

Coastal resources management as a regulatory issue

Widespread agreement exists that changes in behavior are required if ASEAN's coastal resources are to be protected appropriately. Governments have many instruments to compel or encourage such change, but the most common approach to CRM in the region appears to be regulatory (Tobin 1989). Through the use of regulations, governments impose command-and-control techniques and require users of coastal resources to follow certain rules of behavior. These rules can address the size and amount of allowable catches of marine life, net size, areas where trawlers are permitted to operate, the circumstances under which sand can be mined, and minimum setback distances for construction near shorelines. With every regulatory approach, governmental decisionmaking is substituted for a private one.

Regulatory approaches to the management of natural resources are used throughout much of the world, but these come with considerable undesirable institutional baggage. Agencies charged with the implementation and enforcement of regulations frequently find themselves under attack and at odds with those subject to the regulations. Almost by definition, regulation in the environmental arena is acrimonious because it places public and private institutions in conflict. As Wilson (1974) explains, when regulation "arises out of the desire to alleviate widely distributed burdens (such as pollution and misuse of natural resources), then assigning blame becomes virtually a political necessity in order to get the issue on the public agenda...." Because a perceived evil is being

attacked, Wilson hypothesizes that the resulting regulations will be "strong" in that "there will be little incentive in the developmental process to accommodate conflicting interests and thus little incentive to find a politically acceptable formula which all affected parties can live with."

To remedy the ills that provoke regulation, public organizations impose constraints or obligations on private ones. These obligations are often viewed as arbitrary and unnecessarily stringent. A related objection is that environmental regulations are far too costly relative to the presumed or alleged benefits. All too often, critics complain, regulatory agencies with responsibilities for environmental protection are unable to demonstrate a clear link between the costs of compliance and the intended benefits.

Here the spatial and temporal distribution of these costs and benefits is especially important. On the one hand, environmental regulation frequently concentrates costs among relatively few readily identifiable interests (thus sparking resistance) while distributing benefits among a large class of people who may not even know they are beneficiaries. On the other hand, environmental regulation normally imposes costs in the present in anticipation of future benefits. This is a highly undesirable situation for any regulatory agency dependent on public support.

The disadvantage of the situation is compounded in regard to coastal resources. Not only are benefits of improved management expected to occur in the future and are thus discounted, but many are also indirect and difficult for the beneficiaries to observe. This occurs because many of the changes associated with improved management are geographically distant from the beneficiaries. Appropriate restrictions on offshore mining of sand provide an excellent example. While compliance with these restrictions may lead to a wide range of improvements in protection of coastal resources, few members of the public will be able to relate the restrictions to the improvements or even know what the latter are. In contrast, the regulations are likely to lead to increased prices for sand, and these will be felt much closer to home.

In sum, environmental regulations may appear to be administratively simple to develop, but they create a powerful incentive among regulated groups to resist compliance. Successful resistance delays the imposition of costs, but also perpetuates an adversarial relationship between regulators and regulated groups. Moreover, as long as the latter must bear these costs, they continue to have reason to avoid compliance, to object to the regulations and to attempt to change them by appeals to the political overseers of the regulatory organizations. To the extent that these political leaders are responsive to their constituents' concerns, the leaders will constantly seek explanation and justification for the regulations from their bureaucratic and administrative subordinates. In other words, regulatory battles are rarely settled and frequently come up for renewed discussion with every new scientific finding and with each twist and turn in regional and national economic well-being.

Although the emphasis so far has been on organizational arrangements and their effects on CRM, the relevant legal environment cannot be ignored. It is this institutional environment that sets the stage for organizations to operate, grants their powers and authority to act, and determines their mission. Law is similarly used as a means to codify and enforce societal norms. In other words, among other functions, laws provide definitions of and boundaries for acceptable and nonacceptable behaviors.

Laws intended to improve CRM are likely to be reductive, in that their purpose is to reduce the occurrence of undesirable or harmful behaviors (Stone 1975). These include "absolute disfavored conduct," which a society wishes to eliminate entirely and "qualifiedly disfavored conduct," which a society discourages but prefers not to eliminate entirely because the resulting losses could exceed the gains. Blast fishing provides an example of the first type of conduct while water pollution represents the second. The categorization of activities can be an important indicator of a government's commitment to CRM. While many activities that affect coastal resources clearly have associated benefits, all detrimental operations have to be apportioned among various categories of conduct–the two mentioned above plus practices, believed or deemed harmful, that are not subject to any legal penalty or sanction.

Within Southeast Asia, many activities affecting coastal resources are in this third category, primarily because governments have not yet addressed coastal issues comprehensively, now widely recognized as essential. Understandably focusing first on social and economic development, countries within the region have only recently begun to deal with environmental problems. The evidence may be mixed, but it is possible to suggest a hierarchy of governmental reactions to environmental problems. Attention is first devoted to localized problems that have direct and observable consequences, such as air and water pollution, followed by regional problems, like acid precipitation, and then to national and transnational problems, such as global warming and the loss of biological diversity. CRM transcends all three of these levels, so it may be premature to expect governments to address all of the problems associated with it at the same time.

Whatever the process or hierarchy of action, laws are generally approved long after they are needed, in part because they are typically reactions to undesirable situations that have come to be defined as problems. As an illustration, the need for laws prohibiting blast fishing in the Philippines and the use of trawlers in Indonesian waters became obvious only after substantial damage to the marine resources had already taken place. Put in other terms, human and commercial ingenuity outpace societies' ability to respond.

Finally, it is important to emphasize that a law is rarely an end in itself; some other objective is usually in mind. Law is an intermediate step in a process that

assumes its passage to lead to achievement of some ultimate goal or objective, such as cleaner water, protection of coral reefs or the cutting of mangroves on a sustainable-yield basis. With every law, therefore, the key question is whether it will accomplish its intended objectives. Many variables affect the answer to this question, and some will be discussed below. Nonetheless, legal sanctions are not likely to be particularly effective as instruments of social change when: "the behavior to be changed has 'customary support' within the group, involves means condoned (or at least not strongly condemned) by the larger community, and does not result in injuries that the individual actors can clearly and vividly connect with their own behavior" (Stone 1975). One or more of these three traits, particularly the latter, are evident in Southeast Asia in regard to CRM. This suggests, of course, that sole reliance on laws to improve CRM may not be the most efficacious strategy.

Laws, Organizations and Implementation

As noted above, laws rarely represent ultimate goals. Similarly, organizational behavior is normally directed toward the accomplishment of some goal. Most important, if laws and organizations are to have relevance to CRM, then there ought to be some relationship between laws and organizations, and successful implementation. To the extent that there is, we should be able to examine the laws and organizational arrangements we rely on to enhance CRM, then predict how successful our efforts will be. Such an assessment of the feasibility of implementation might usefully include the following questions (adapted from Hargrove 1975; Van Meter and Van Horn 1975):

1. Relative to existing policies and procedures, how much change will be involved with the implementation of the proposed measures?
2. Among the organizations dealing with implementation, how much consensus is there about the program's goals?
3. Will this implementation require cooperation among many governmental agencies or departments?
4. Do the staffs of the relevant government agencies have the professional capabilities to perform the work required?
5. Will the proposed measures require different behaviors on the part of government employees?
6. If yes, how realistic is it to expect these behaviors to occur?
7. Are there private groups whose interests will be affected adversely by implementation of the proposed measures?
8. Are the local communities that will be affected supportive of the proposed measures?

Although more questions can be added to this list, the ones above provide a fairly straightforward way to assess the feasibility of implementation from an organizational perspective (Hargrove 1975). Equally important, all the questions suggest the relative importance of a better understanding of how government organizations and bureaucracies operate to achieve desired goals. In the quest for successful implementation, therefore, advocates of change who ignore legal and organizational considerations do so at their own peril. Just as we would find ourselves at a considerable disadvantage if we tried to play a game without knowing the rules, so also would we realize the difficulty to improve CRM unless we knew how to marshal our legal and organizational resources to full advantage.

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The Use of Remote Sensing and Geographic Information Systems in Coastal Zone Management*

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Abstract

This paper outlines the opportunities and constraints in the use of remote sensing technology and geographic information systems (GIS) for coastal zone management (CZM). Extensive applications of remote sensing under ASEAN/US CRMP were hindered by cost, lack of familiarity with the methodologies, lack of technical expertise and inaccessibility of remotely sensed data. The use of GIS in CRMP was limited to the Malaysian project. Although many of the real-world complexities of the coastal zone cannot be adequately represented in current GIS, it still serves as a useful tool for CZM.

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While the advantages of combining remote sensing and GIS technology for studies such as CZM are recognized, some practical difficulties are faced in its actual use in projects like CRMP.

An institutional GIS framework must be established in developing countries to build up the technical capabilities, provide the mechanisms to maintain/update the system and ensure sustained support.

Introduction

For the past 20 years or so, inventory and assessment of the earth's resources and economic activities have been greatly enhanced through the use of remote sensing and GIS, aided in part by innovative developments in computer technology.

Remote Sensing

Acquisition of information about an object with the use of a sensor which is not in physical contact with the object is called remote sensing. Sensor systems (e.g., cameras, radiometers or radar) mounted on elevated platforms (e.g., aircraft or satellites) detect and measure electromagnetic energy reflected or emitted by an object. Such sensor systems may be active, such as radar, or passive. The latter type relies on the radiation naturally emitted or reflected from the target (e.g., terrain, land cover). The data generated may be recorded in either digital or photographic forms. Remotely sensed data which are not camera-based are usually in digital form and typically stored in computer compatible tapes. These are processed through the use of image processing systems (IPS). The IPS consist of hardware (computer) and software which transform the digital data into images. The IPS preprocess the data by making the necessary radiometric (e.g., effect of haze) and geometric (e.g., effect of earth's rotation) corrections. The preprocessed data are displayed in a computer and further processed using enhancement and spectral classification techniques to match the spectral signals with ground information (e.g., vegetation, landforms). The main purpose of image processing and analysis is to extract relevant information, which is then represented in thematic maps and interpreted for various purposes such as environmental assessment, cartography, meteorology, military and management.

Fig. 1 shows an example of a remotely sensed satellite image. As can be seen, it provides a synoptic view of the earth's surface. Supported by ground reconnaissance data, it is one potential source of wide-area coverage data on the earth's surface.

Applications of remote sensing in coastal zone studies

Remote sensing technology has been widely used for meteorological studies and land resource evaluation, especially with the launching of meteorological

satellites such as the NOAA series, the GOES series, METEOSAT and GMS; and earth resource satellites such as the LANDSAT series and SPOT. Although the meteorological and earth resource satellites were designed primarily for meteorological and land applications, respectively, remotely sensed data from these satellites have also been employed for studying coastal and ocean phenomena.

For example, the Coastal Zone Color Scanner deployed on the Nimbus-7 satellite had provided valuable data for studying ocean color for over 7 years. Data from the infrared radiometer, AVHRR (A Very High Resolution Radiometer), deployed on the NOAA satellites have also been used to study sea surface temperatures. The suite of microwave sensors on SEASAT, although short-lived, demonstrated the ability of remote sensing surface wind and wave conditions.

The high spatial resolution of multiband radiometers on LANDSAT and SPOT has also proven useful not only for land-based studies but also for research on shallow-water bathymetry of coastal areas. They are a useful source of data for coastal zone studies, which include both the land and coastal waters. Coupled with the use of digital mapping and GIS technology, they offer considerable potential as tools for coastal zone planning and management (Butler et al. 1988; Kam 1989a).

Landsat Thematic Mapper (TM) has a ground resolution[1] of 30 m and uses 7 spectral bands (violet-blue to infrared) with coastal applications as outlined in Table 1 (Conant et al. 1983). In contrast, SPOT has 3 multispectral bands (for color images) with ground resolution of 20 m, and in the panchromatic mode (for black and white images), the resolution is 10 m (Butler et al. 1988). In essence, SPOT has a better spatial resolution, but poorer spectral resolution than Landsat TM. Multispectral data from Landsat TM and SPOT have been used in land use assessment, urban planning and coastal studies, particularly in the intertidal zone (e.g., bottom substrates and algal species differentiation) (e.g., Brachet 1986).

The applications of remote sensing to the marine environment were reviewed in Johnson and Munday (1983). Information on suspended sediment in the water column, topography, bathymetry, sea state, water color, chlorophyll-a, sea surface temperature, fisheries, oil slicks and submerged or emergent vegetation including mangroves, has been provided by available remotely sensed data. Remote sensing has also been used in inventory and assessment of various coastal resources as well as production of maps. In a study done by Hyland et al.

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[1]Resolution, the minimum distinguishable size of an object or area, is given as an aerial measurement of a square. For example, a resolution of 30 m means that to be distinguishable, an object must cover an area greater than or equal to a square measuring 30 m on a side. The smaller the number, the higher the resolution.

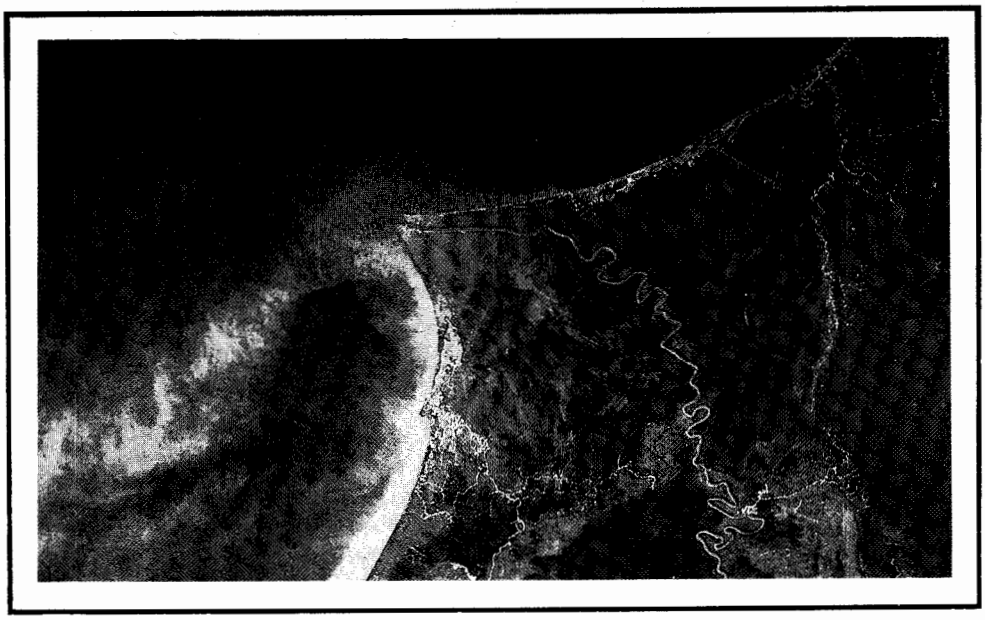

Fig. 1. A remotely sensed image of an area between Brunei Darussalam and Sarawak, Malaysia (Borneo Island) in false color composite taken from Landsat TM.

Table 1. Coastal applications, band designations and spectral ranges of the Landsat TM.

Band	Spectral range (μm)	Color	Application
1	0.45-0.52	violet-blue	For water body penetration, useful for coastal water mapping, also for differentiation of soil from vegetation.
2	0.52-0.60	green	Measures visible green reflectance peak of vegetation for vigor assessment.
3	0.63-0.69	red	A chlorophyll absorption and for vegetation discrimination.
4	0.76-0.90	near infrared	Useful for delineation of water bodies and determining biomass content.
5	1.55-1.75	middle infrared	Indicative of vegetation and soil moisture content; differentiation of snow from clouds.
6	10.40-12.50	thermal infrared	Used in vegetation stress analysis, soil moisture discrimination and thermal mapping.
7	2.08-2.35	middle infrared	Discriminates rock types (geological applications); for hydrothermal mapping.

Source: Conant et al. (1983).

(1989), Landsat TM was used for monitoring seagrasses. The results indicated that TM imagery can be enhanced to highlight dense seagrass either on exposed intertidal banks or in clear, shallow (less than 2 m) water. Seagrasses grow well in the intertidal zone and are susceptible to foreshore modifications. Therefore, TM imagery gives a useful method for monitoring this important coastal habitat. A comparison between traditional mapping methods and satellite-aided mapping for seagrass (Lennon and Luck 1990) showed that over a large area, the latter achieved high accuracy with less cost than traditional methods, which would require extensive and costly field sampling activity.

Remote sensing has been utilized to map atolls, coral reefs and islands (Bainbridge 1988; Hu and Faiz 1990). In using remote sensing (aerial photography and satellite imagery) for reef fisheries planning in the Maldives, Yun and Faiz (1990) were able to correlate water color and other marine environmental factors with the amount of phytoplankton in a reef lagoon to estimate marine primary productivity. They were able to deduce that areas which showed high phytoplankton biomass corresponded to fishing grounds.

More comprehensive information on water quality parameter patterns in bays or estuaries can provide a better understanding of the ecology, biology and dynamics in these ecosystems which are important inputs to management. Coupled with ground measurements such as for turbidity, chlorophyll-a content and transparency, remote sensing leads to better understanding of the hydrodynamic condition of the system, particularly on the productivity of marine waters and indirectly on fisheries biomass (Khorram 1981a and b; Lin et al. 1984; Lathrop and Lillesand 1986; Khorram et al. 1987). The results of a study by Khorram et al. (1991) have been useful for modeling temperature, transparency, turbidity and chlorophyll-a. While the same water quality parameters can be investigated through conventional survey techniques, these are time-consuming and expensive, and fail to represent the distribution of these parameters other than the sample areas. Remotely sensed data provide a synoptic view and thus, may be applicable to modeling, mapping and monitoring of water quality.

With respect to CZM, remote sensing can provide a feasible means for mapping, particularly for insular (archipelagic) countries. For example, in countries with many scattered islands (e.g., Indonesia and the Philippines), land inventory is usually difficult and expensive using conventional survey methods, even with the use of aerial photography. The synoptic coverage of satellite remote sensing makes it less costly in the long run, especially for mapping wide areas of land and vegetation cover.

Problems and constraints

Despite the undoubted potential applications of remote sensing techniques to the study of the coastal zone, there are still limitations and practical problems encountered in their use.

For a dynamic system like the sea, which varies on time scales of seconds, minutes, hours and days, the temporal resolution (i.e., the frequency of data acquisition) of remotely sensed data becomes more important than it would be for land applications. This is particularly so in the case of coastal waters which are tidally dominated, whereby changes occur over short time spans of minutes and hours. Earth resource satellites, with a revisit time interval of 16 to 26 days, cannot provide the temporal resolution to capture the dynamism of coastal waters.

Furthermore, the use of such data of low temporal resolution gives rise to difficulties in interpretation of imagery taken at different tidal times, as encountered in the mapping of reefs in shallow waters, where the spectral response pattern of the same reef can differ vastly depending on the water depth, which fluctuates with the tide (Bainbridge 1988).

Perhaps the most serious constraint faced in the use of satellite data from passive remote sensing systems is cloud cover. It has been estimated that at a latitude of 50° N in Europe, there is only a 5% chance or less of obtaining two consecutive satellite images of the same area containing less than 30% cloud (IOC 1992). The situation can be expected to be far worse in the humid tropics, especially in the coastal zone, where it is not uncommon to find a band of cloud hugging the coastline while the landward interior might be cloud-free. The uncertainty of obtaining cloud-free data makes ground reconnaissance difficult. The use of active remote sensing systems, i.e., microwave sensors, airborne or on satellites (such as those in SEASAT and the new ERS-1), is the only way to overcome cloud cover problems. However, microwave data cannot totally replace passive remotely sensed data for all sea and ocean studies, such as ocean color.

Another problem facing the use of remotely sensed data for the study of waters is the poor penetration of electromagnetic radiation. Thus, most of the coastal and marine phenomena sensed remotely are surface phenomena. While light penetration per se may not be as serious a problem in shallow coastal waters, a different problem is faced in the interpretation of remotely sensed data for coastal waters. This is the confounding factor of suspended and dissolved matter with water depth in the reflectance of electromagnetic radiation by the water body. Moreover, the additional factor of atmospheric interference would also need to be considered. A great deal of effort in image processing of remotely sensed data for water studies has gone into the development of models and algorithms to mask the various confounding effects, many of which are still largely empirical.

Potentially, airborne remote sensing allows for greater flexibility in the deployment of sensor type, time and frequency of data acquisition, and selective areal coverage. However, such facilities are not easily available in this part of the world, and are also very costly. In many countries in this region, CZM studies still resort to the more conventional use of aerial photographs, to which access is

generally restricted. The poor light penetration and the absence of spectral resolution in conventional panchromatic aerial photographs render them of little use in coastal water studies.

Notwithstanding these limitations, remote sensing is an appropriate method for addressing information needs in decisionmaking for natural resource development and environmental management. Despite recognition in the Asia-Pacific region of the importance of this technology, its integration into national development planning processes has not been well established. Many users in developing countries face budget constraints in acquiring expensive satellite data. Besides, the promise of obtaining real-time satellite data falls short in reality, especially in this region.

There will be an increasing interest in spatio-temporal studies covering disaster forecasting and monitoring, deforestation, desertification, soil erosion, agriculture, ocean management and coastal zone studies in the Asia-Pacific region. Many of these applications extend across national boundaries and require coordinated efforts among concerned countries. These may take the form of information sharing, technology exchange and collaborative research.

Asia has a sufficient areal coverage of satellite data from the many receiving stations. Ground stations should thus form a coordinated network through cost-sharing schemes which would result in lower operational fees. Countries without ground receiving stations may opt for a batch supply arrangement with existing receiving stations instead of investing in their own infrastructure.

Geographic Information Systems

Geographic information systems (GIS) technology was developed from, and integrate concepts and techniques from various disciplines such as geography, statistics, cartography, computer science, biological sciences, mathematics, economics and geosciences, among others (Maguire 1991). For the purpose of this paper the following definition is adopted:

> GIS are computer-assisted systems that can input, retrieve, analyze and display geographically referenced information useful for decisionmaking.

GIS are sometimes regarded as synonymous with other information acquisition and management systems such as computer-aided design (CAD), computer cartography, database management and remote sensing. On the contrary, while GIS may have certain elements or capabilities in common with these other systems, the functions of the former cannot be wholly met by any one of the latter. At best, the relationship of GIS with these other systems is depicted

in Fig. 2. CADs are graphic-based systems with rudimentary links to databases and limited analytical capabilities. Although computer cartography involves digital geographic information (maps), it uses simple data structures that lack topological information. The system emphasizes display of maps rather than retrieval and analysis of spatial information. Database management systems (DBMS) have limited graphical retrieval, display and spatial analytical capabilities but are powerful tools for storage and retrieval of nongraphical attribute data. The DBMS are often linked to GIS to access attribute data. Remote sensing which was discussed at length earlier in this paper, has limited capabilities to handle attribute data and to conduct true spatial analysis (Maguire 1991).

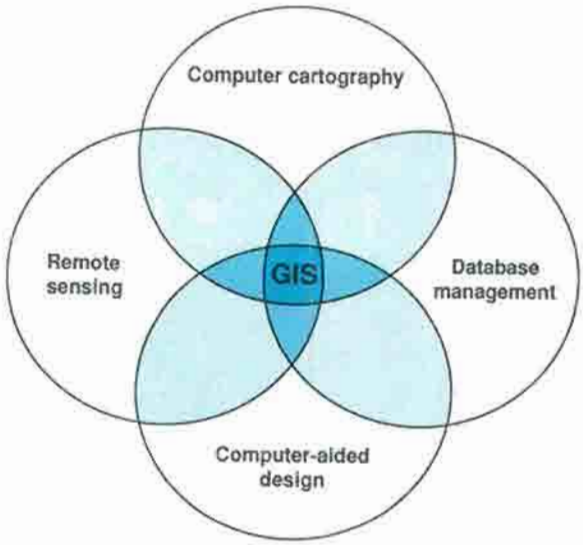

Fig. 2. The relationship of computer-aided design, computer cartography, database management and remote sensing information systems with GIS (Maguire 1991).

From an operational perspective, the four basic components of GIS are computer hardware, computer software, database and manpower (Maguire 1991). The GIS are supported by at least three classes of hardware–mainframes, personal computers and workstations. The widespread use of personal computers has made it possible for relatively small organizations to use GIS. Many GIS software on the market today are designed for different hardware and data structures. The cost of software ranges widely. Generally, the less expensive GIS software run on personal computers, with public domain GIS being the cheapest (Meaden and Kapetsky 1991). Choosing a GIS software will depend largely on the user's need or intended application.

The database is a crucial component of GIS. The effort and costs of establishing and maintaining a proper database should not be underestimated in a GIS project, especially in countries where digital databases are not readily available, and even geographic information is sparse, often outdated or restricted. It has been said that up to 80% of the effort goes into creating the database before GIS can be put into use.

The last and equally important component is people with the necessary training or knowledge in GIS, spatial analysis and related fields. Although training programs are now available (vendor-initiated, short-term courses and degree/diploma programs), there is still a shortage of trained personnel, especially in developing countries. With the interest generated, it is expected that there will be a rapid adoption of GIS technology in these countries. This will outpace human resource development to handle the technology. The potential of GIS for a wide range of applications and ability to integrate data from disparate sectors require users with broad and interdisciplinary perspectives, besides the subject specialists, to make the best use of the technology. Part of this temporary void is being filled by external consultants (Clarke 1991). Nonetheless, it is important that these countries place emphasis on building up local expertise and capability to adapt the technology to their specific needs.

Basic functions of GIS

The capability to perform several basic functions distinguishes GIS from the other information systems mentioned earlier. These functions are data collection, storage, manipulation, analysis and graphical presentation. A model of the real world, referred to as a geographical model, is usually represented by two types of data in GIS–spatial and attribute. Spatial data refer to entities with geographical location (e.g., coordinates in longitude and latitude, identifiable landmarks) while attribute data are characteristics or traits of an entity or location such as object and place names (e.g., water tank, Manila, Kuala Lumpur). Spatial data are generally represented by two types of data structures: vector and raster.

In the vector data structure, geographical entities such as points, lines and areas (polygons) are represented as a series of coordinates in space. This data structure is boundary-oriented, wherein a fuzzy or indistinct boundary (e.g., soil type boundary) is represented as a distinct line, or otherwise as bands of distinct lines.

In a raster (also called grid or tessellation), geographical features are represented as discrete polygonal units which are either regular squares like grids (as pixels in the computer monitor) or irregular triangles and hexagons. It is area-oriented, encoding the content of areas rather than the boundaries between them. Multiple map overlays are more efficiently carried out in the raster than the vector mode.

Most GIS software are either vector- or raster-based, but there is now an increasing trend to utilize both. In general, the raster data structure requires considerable memory for data storage. To overcome this problem, methods of increasing data storage efficiency have been devised. One solution is the use of the quadtree data structure, which is also area-oriented. Quadtrees differ from grids in that in the former there is a hierarchical subdivision or partitioning of space into quadrants and subquadrants only where heterogeneity occurs at the boundaries of polygons. This saves much memory capacity for data storage.

Maguire and Dangermond (1991) identified the functional components of GIS: data capture, data transfer, data validation and editing, data storage and structure, data restructuring, data generalization, data transform, query, analysis and data presentation (Fig. 3). While most of the commercially available GIS have these generic capabilities, they vary in sophistication and ease of use. Some software may be better developed for certain functions, such as cartographic output and presentation, than other functions, like particular kinds of analysis.

Two important functions of GIS are query and analysis. Query can be carried out on the spatial data, or through the link between spatial data and the non-spatial attributes. The two main query functions on the spatial data are spatial search and map overlays. Spatial search is done by specifying a zone of interest, i.e., buffer or corridor, around the feature in question, to ascertain what lies within this zone. Map overlay allows for comparison of features in two or more map layers for any location of interest, e.g., determining elevation, land cover type, soil type, land tenure and ownership of a particular point in question. By establishing logical links between spatial data and their non-spatial attributes, it is also possible to point at a geographical feature and query its associated attributes, e.g., determine the owner's name, type of building, building use at a particular location; or specify a criterion of the non-spatial attribute and determine the spatial entities fulfilling the criterion, e.g., display all factories producing a certain kind of pollutant.

Various kinds of spatial analysis can be carried out in GIS. These include analyzing the areal extent of map classes; "point operation" type analysis through algebraic and topological overlays of multiple map layers; "neighborhood operation" type analysis relating the properties of points on a map surface with their immediate surroundings; and "network operation" type analysis using linkages and flows among linear features. The tools for spatial analysis available in many commercial GIS are varied. It is left to the ingenuity of the user to employ them, alone or in combination, to address specific problems. Many GIS software nowadays come with macroprogramming languages which can be used to string all kinds of GIS operations together; thereby providing a toolkit with which the user can tailor-make application routines to meet specific needs.

The output of GIS could be in the form of maps (colored or in shades of gray; see Fig. 4 for an example), tables, graphs, statistical summaries and reports.

Applications of GIS

Many applications of GIS have been in the field of land use management–agriculture, forestry and urban development (cadastre, transportation). Only in recent years has there been widespread application in environmental and aquatic sciences, and socioeconomics. GIS have also been used in the military, global climate modeling and geosciences, especially with three-dimensional GIS. Table 2 shows some of the applications of GIS in the coastal zone, especially in fisheries.

The Benefits of GIS in Resource Management and Planning. The benefits of using GIS in resource management are generally recognized, and have been widely documented from applications developed in various countries for different types of natural resources such as conservation area and forestry management. In general, the main benefits include:

1. ability to integrate data of various types (graphic, textual, digital, analog) from a variety of sources;
2. greatly enhanced capacity for data exchange among various disciplines and departments concerned;
3. ability to process and analyze data more efficiently and effectively than can be achieved manually;
4. ability to model, test and compare alternative scenarios before the proposed strategy is imposed on the real-world system;
5. facility for efficient updating of data, especially graphic; and
6. ability to handle large data volumes.

Being an integrative system, GIS can undertake multicriteria modeling which can be useful in coastal zone and resource management where a holistic or integrated approach is required.

The Utility of GIS for Coastal Zone Studies. In evaluating the suitability of GIS for CZM planning purposes, one has to recognize the special features of the coastal zone which might place specific requirements on GIS, in terms of data model, structure and algorithms, and database management techniques (Bartlett 1990).

A complex and dynamic geographic entity, the coastal zone can be perceived as having four main characteristics:

1. *Breadth* refers to the width of the maritime influence on the land, and of the terrestrial influence on the sea.
2. *Depth* relates to the volume of water, with variable vertical distribution of currents and nutrients that influences fish and coral assemblages, and sediment dispersal.
3. Coastal areas have *"fuzzy" boundaries,* i.e., the demarcation line between land and sea, and what is coastal and not at both the sea and land limits, are not well defined.
4. A wide array of spatial scales and resolutions is needed to represent *different processes and phenomena* in coastal areas. These range from the

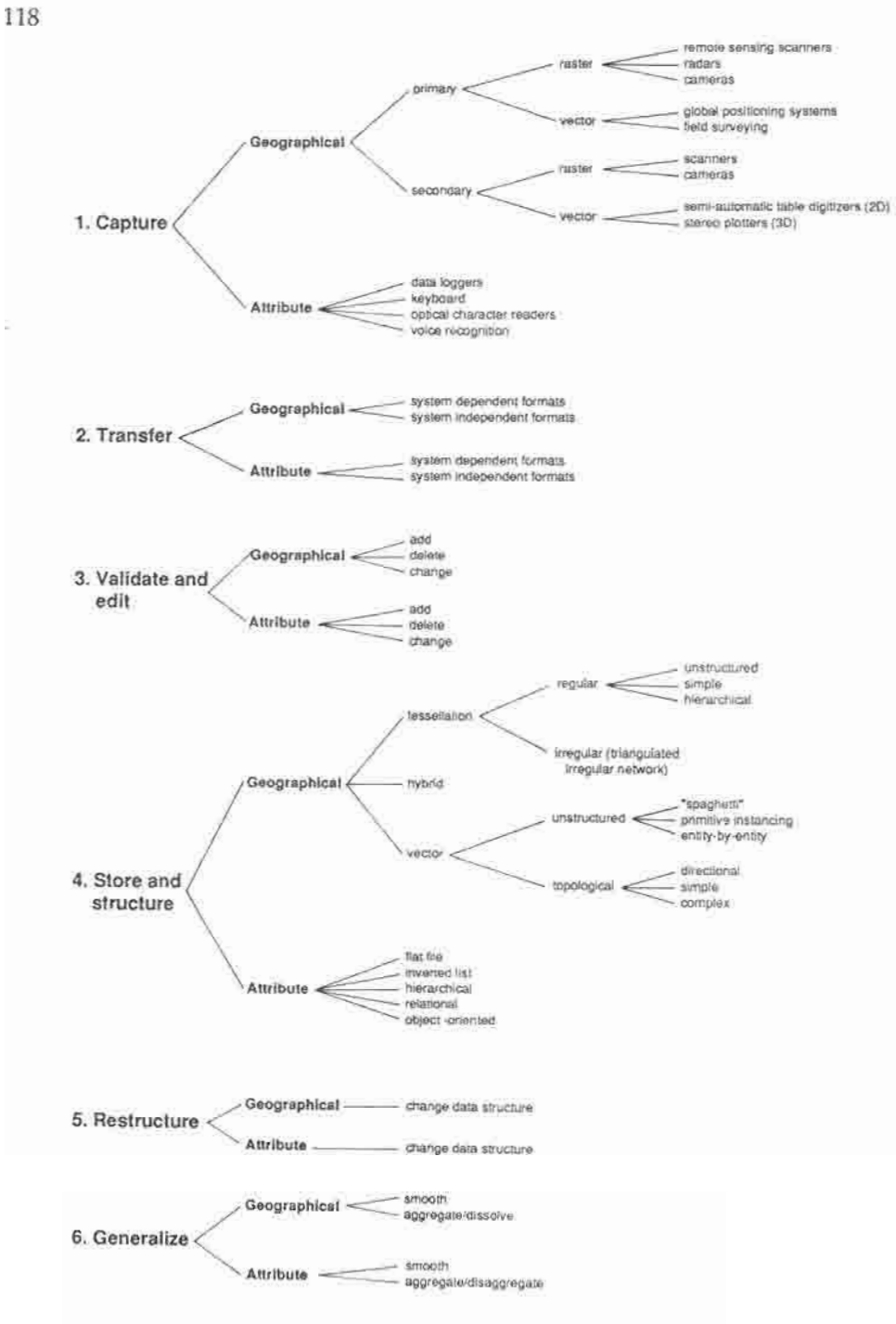

Fig. 3. The functional components of GIS (Maguire and Dangermond 1991).

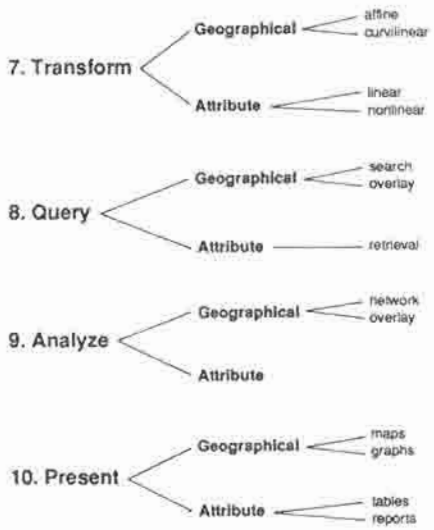

Fig. 3. (continued)

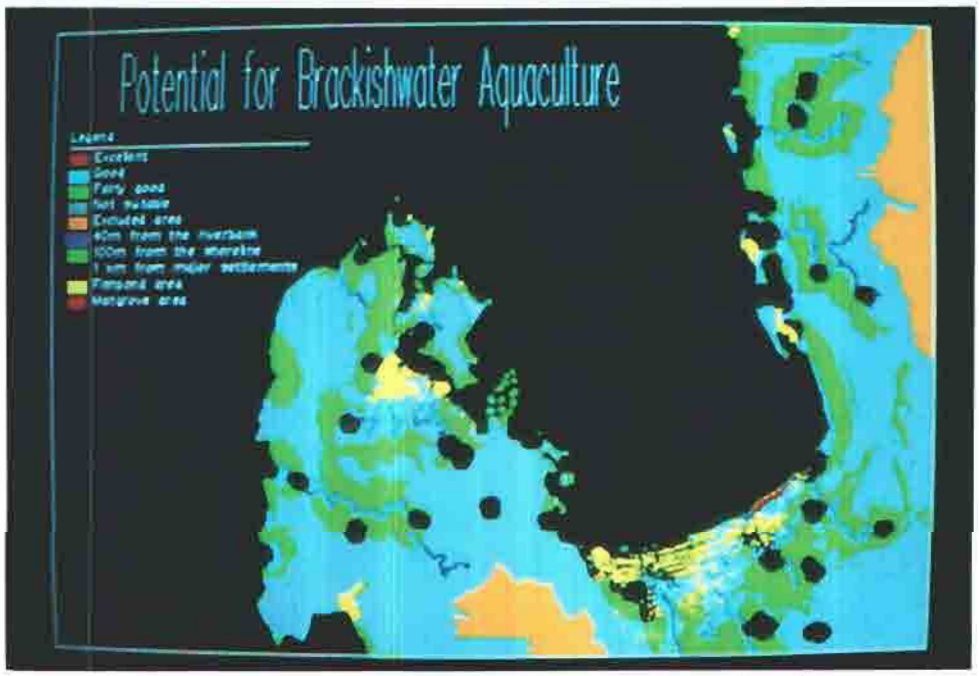

Fig. 4. A GIS-generated map showing potential areas for brackishwater aquaculture farms.

Table 2. Some applications of GIS in the coastal zone.

Field of application	Brief description
Cartography	A study by the United States Geological Survey to produce topographic maps of the nation for use of federal and state agencies, commercial companies and individual citizens at 1:24,000 scale series.
Land management	Profiles developed for each drainage basin based on GIS inventories of the extent of forest lands, cultivated land, urban areas, stream shore, lake shore, silt soil, sand soil areas of 3-6% slope and other parameters for water resource assessment.
Freshwater habitat management	A case study on impact assessment of contaminants. Creates databases for habitat potential, attribute file of habitat condition and stream dimensions, watershed boundaries, point file of contaminant discharge. Describes downstream impact in terms of proportion of fish production loss. Analyzes habitat affected by contaminants and converts habitat areas into fish production.
Marine habitat management	Creates database for various attributes, point data, bathymetry, sediment type. Establishes criteria for suitable habitat model by describing relationship between spatial variables. Overlays maps to produce the desired output.
Potential for aquaculture development	Datasets used are salinity requirements, soil characteristics, rainfall pattern, land use (mangrove vs. nonmangrove area) for determining potential area for shrimp farming.
	Datasets used are environmental parameters, infrastructure, land use, soil types, hydrographic factors, coastal geomorphology and meteorological characteristics for determining potential area for aquaculture development.
	Datasets used are water quality, existing land-use patterns, distance from water source, geomorphological features and distance from existing aquaculture farms for determining potential area for shrimp and fish hatcheries.
Coastal resources study	Identifies socioeconomic variables which might influence developments in a coastal environment. Datasets used are population, employment statistics, income levels, educational background, infrastructure and public amenities.

Sources: Kam (1989b); Hanafi et al. (1991); CISM (1992).

microscopic scale of chemical processes acting on sand and rocks of the intertidal zone, to those measured in tens, hundreds and thousands of kilometers (e.g., fishery licensing zones, shoreline retreat and accretion, areas of operation of fishing gear).

Ideally, selected GIS should be able to deal with these special features and complexities of the coastal zone. True three-dimensional GIS that can handle a

third dimension of depth (or height) have yet to emerge. Nevertheless, most GIS available today can represent three dimensions in two-dimensional space. The addition of a fourth dimension, time, to deal with dynamic situations like coastal processes, is beyond the horizon of GIS software development at this stage. While the uncertain boundaries of the coastal zone are now arbitrarily represented as discrete, the introduction of fuzzy logic into GIS algorithms is being researched.

Many of the real-world complexities of the coastal zone cannot be adequately captured and represented, spatially and temporally, in GIS. Future advances may improve its capabilities. However, current GIS, while employing simplifications of the coastal zone models for spatial display and analysis, are still a useful tool for CZM planning.

Criteria for evaluation of GIS for CZM

Selection of GIS for any particular use should basically be needs-driven. Most of the needs for CZM have much in common with those for resource management. A few requirements may be peculiar to the nature of the coastal zone, as described above. The main criteria that might be considered in evaluating the suitability of a particular GIS for CZM include the following:

1. the extent to which the intrinsic data model and data structure used by the system are amenable to the wide-ranging spatial scales and resolutions required of coastal zone studies;
2. the efficiency and effectiveness with which spatial and nonspatial data are captured, edited, stored, retrieved and displayed; and
3. the kinds and capabilities of spatial analysis tools for modeling the coastal zone properties and processes.

The volume and storage capacity of GIS may also be an important consideration for a big project, but this is largely determined by hardware configuration.

As an example, two commercially available software, SPANS and ARC/INFO[2], are evaluated in this paper. They use different data models and structures, which provide an interesting comparison on their handling of coastal resource data. However, this does not preclude the applicability of other GIS software for coastal zone studies.

Spatial Analysis System

The Spatial Analysis System (SPANS) was first released as a microcomputer-based GIS in 1986, using the disk operating system (DOS) and the quadtree. The

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[2]SPANS and ARC/INFO are registered trademarks of TYDAC INTERA Technologies of Canada and of Environmental Systems Research Institute, Inc., USA, respectively.

software has since undergone several rapid revisions; the 5.2 version operates on DOS-based IBM-compatible microcomputers, and with OS/2 Presentation Manager on the IBM PS/2. Another version operates with AIX on the IBM RISC System/6000 workstation.

While vector and raster analytical capabilities have been added in the 5.2 version, the analytical core of SPANS is still quadtree-based. For two-dimensional space representing a region, the quadtree structure decomposes the space into rectangular cells of variable size, with the finest pixels at the polygon boundaries. The cell resolution is determined by the quadding level, which is user-defined. Quadtrees are storage-efficient compared with rasters at equivalent resolution, even considering raster structures with data compaction features such as run-length encoding. This storage-efficient feature gives the microcomputer-based SPANS the ability to handle large numbers of data files, such as in the ASEAN/US CRMP study for South Johor (Kam et al. 1990).

This type of data structure allows for selection of resolution of individual map layers, depending on the accuracy of the source data; for example, a fine resolution for more accurate topographic data and a coarser resolution for reconnaisance-level soil maps. By user selection of the quadding level, one can choose a finer decomposition of geographic space at selected (zoomed-in) areas for more detailed study, say at an estuary of interest, or more generalization when the area in question is viewed from the broader perspective of the whole.

More importantly, quadtrees can carry out most of the topological overlays of the "point operation" type (Tomlin 1983) that raster structures can, and even more efficiently. However, the inability of quadtrees to handle the "neighborhood operations," such as visibility analysis, and "draining" and "spreading" over a digital elevation model, has led to the subsequent use of the raster structure for such analyses in SPANS version 5.2. This version also features some limited vector-based analysis, specifically network analysis for optimum routing.

ARC/INFO

One of the earliest GIS products to be marketed, ARC/INFO started as a minicomputer-based GIS, which was subsequently adapted for use on microcomputers. At present, two major products are popularly sold--ARC/INFO operating with UNIX on the workstation (most current release is version 6.1), and pcARC/INFO operating with DOS on IBM-compatible microcomputers (most current is version 3.4D plus). The ARC/INFO is primarily vector-based, although the UNIX-based Release 6.1 now features raster-based analysis. While most of the basic functions of the workstation-based ARC/INFO are available on pcARC/INFO, there are certain file size limitations on the latter. In addition, certain features of the UNIX-based software, such as coordinate geometry, ability to interface with structured query language (SQL)-supported external relational

database management software (RDBMS), the Advanced Macro Language (AML), as well as the new raster analytical and linear geoprocessing (or dynamic segmentation) capabilities of Release 6.1 (Perkins 1992), are not available on pcARC/INFO.

Being primarily vector-based GIS, ARC/INFO and pcARC/INFO can represent the coast as a one-dimensional linear entity, as might be done at a small mapping scale of a long coastline. This simple data model of a coast might be sufficient for certain applications, such as mapping its environmental sensitivity at a small mapping scale. In such an application, the dynamic segmentation technique (Doyle 1991) available on ARC/INFO Release 6.1 is suited for documenting and processing the multiple variables of environmental sensitivity which are recorded in linear measures along the coastline.

However, if the coastal zone is primarily studied as an integrated area, the use of a one-dimensional linear model of the coastline can be severely limiting. In this case, there is no clear advantage of the use of dynamic segmentation. The coastal zone is represented as polygons in a vector data structure, and generalizations from a large to a small mapping scale are done through coarsening and collapse of polygons of specified sizes. This procedure requires more input from the user and more processing steps than are needed for quadtrees.

Comparison of SPANS and ARC/INFO-pcARC/INFO

There are two approaches to a comparison of GIS software. One is to compare the total capabilities of the two GIS, which pits the essentially microcomputer-based SPANS against the workstation-based ARC/INFO. This is not fair, however, because of the vast differences in system (hardware and software) costs. The other approach would be to compare the main features of the two GIS at a comparable platform, i.e., the microcomputer, which gives some indication of "value for money" of the GIS implementation for CZM (Table 3). The comparison is primarily between the two microcomputer-based versions; the additional features of the workstation-based ARC/INFO are listed in the third column of Table 3.

On the whole, the cartographic capabilities of the vector-based ARC/INFO are generally more well developed than those of SPANS, with many editing and plotting functions of the former being devoted to high-quality, computer-aided map production. The data management capability, especially query of the nongraphic data through its link to the internal RDBMS, is also better for ARC/INFO, which allows for a one-to-many tabular relationship of nongraphic files.

On the other hand, the spatial analytical capabilities of SPANS, except vector-based analysis such as network analysis, are generally more powerful and efficient than those of ARC/INFO, especially pcARC/INFO. The usual topological

Table 3. Comparison of main features of SPANS and ARC/INFO.

Basic function	SPANS	pcARC/INFO	ARC/INFO
Data capture and conversion			
Digitizing	Arc-node Topology building more cumbersome	Arc-node Topology building more conveniently done after editing	
Conversion of digital graphic data	Accepts vector and raster files from other GIS in various formats Raster files can be converted to quadtree maps to be used in all spatial analytical operations.	Accepts vector and raster files from other GIS in various formats Raster files need to be vectorized.	
	Accepts raster and image files from IPS in various formats. Image would have to be registered prior to import. Version 5 has some image enhancement capabilities.	Does not support image integration	Image integrator module allows for manipulation of images, including rectification to vector maps.
Editing	Editing done in digitizing module; fewer editing features No "rubber-sheeting" features Map joining awkward for linear features	More editing features Has "rubber-sheeting" features Better map joining features	Improved editing features Additional map rectification features
Database management	Storage of graphical data generally more efficient	Storage efficiency dependent on complexity of arcs	
Query of data base	Real-time multiple map and point queries; weak in query of arcs	Queries generally done in INFO, then subsetted data displayed graphically, not real-time	Additional association of attributes with nodes; dynamic segmentation, which allows for association of attributes with parts of arcs.
	Selective retrieval of attributes done in attribute modeling	Selective retrieval of attributes done in INFO	
Link with RDBMS	Has internal attribute files Version 5 (OS/2) allows for SQL queries using IBM OS/2 Data Base Manager.	Internal RDBMS called INFO Does not support SQL queries to external RDBMS	Supports SQL queries to external RDBMS
Graphic display and plotting	Fewer cartographic tools for output display and pen plotting	Better cartographic tools to create plot files for pen plotting	Improved cartographic tools

Continued

Table 3 (continued)

Basic function	SPANS	pcARC/INFO	ARC/INFO
Analytical tools			
Area analysis	Accuracy of area report dependent on quadding level; no automatic perimeter reporting	Area and perimeter reporting automatic; generally more accurate	
	Real-time single map and two-map cross-tabulation of areas	Two-map cross-tabulation of areas requires actual map intersection.	
Topological overlays	"Point operations" type of overlays, such as matrix and indexing, generally more efficiently carried out	Such overlays done in the vector mode are cumbersome, requiring step-by-step map boolean operations of map intersection, union, identity, etc.	Such overlays can now be more efficiently done in the raster mode
	Spatial modeling gives flexibility in overlays of map layers and modeling of map attributes, using a wide range of map operators. Up to 40 maps can be overlaid simultaneously.	Limited modeling language (SML) available for macroprogramming	AML available, supports both vector and raster-based processing
Neighborhood analysis	Version 5 has raster analytical capabilities, including various filtering algorithms and visibility analysis.	No raster analysis	Raster analytical tools available
Spatial interpolation	Generally more efficient spatial interpolation tools for point data, including chloropleths, voronoi, contouring, potential mapping and point aggregation	No potential mapping and point aggregation	
Vector analysis	Version 5 allows for limited network analysis, mainly routing.	More network analysis functions, including routing, allocation and districting; directional flows and differential resistances allowed	Linear geoprocessing using dynamic segments
Topological analysis	Version 5 allows for modeling of relationships between areas based on adjacency and containment.	Adjacency and containment relationships of polygons inherent in vector data structure	

overlays of the "point operation" type are more efficiently done with raster and quadtree data structures. Both GIS have now incorporated raster-based analytical functions of the "neighborhood operations" and "region operations" nature, but the raster analysis is currently only available in the workstation-based ARC/INFO, not in pcARC/INFO. Besides, SPANS has a wider range of spatial interpolation options, which comes in useful for sampling point data of continuous and semi-discrete variables.

Lastly, the spatial modeling language of SPANS allows for flexibility of writing macros addressing graphic as well as nongraphic data. This facility is useful if a great deal of spatial analysis is required of the study or project. The AML facility for writing macros is present in ARC/INFO, while a simpler version, the Simple Macro Language (SML), is available for pcARC/INFO.

Integration of remote sensing and GIS

There are some clear advantages of using remote sensing and GIS technology in a complementary manner. Fig. 5 shows schematically the role of remote sensing in documenting geographical phenomena of the real world and in providing such information to GIS. Remotely sensed data, and the products of image processing, are already in digital form with more or less standard or known formats. Although raw remotely sensed data are not geographically correct, preprocessing using well-established algorithms in image processing software can bring the data to acceptable levels of geographical accuracy, which can register with other conventional map data. Especially in countries where geographical information obtained through conventional means is difficult to come by, remotely sensed data can fill the gap by providing essentially uniform coverage over large areas at reasonably high positional accuracy, spatial and temporal resolution (Ehlers et al. 1991).

There are several ways to integrate remotely sensed data and GIS (Campbell 1987):

1. Aerial photographs and photographic output of satellite images (subjected to some preprocessing and image enhancement) are manually interpreted, and hand-drawn thematic maps, e.g., vegetation cover, are digitized into GIS.
2. Digital remotely sensed data are analyzed or classified digitally, the outputs are produced in hard copy as conventional maps, which are then digitized into GIS.
3. Digital remotely sensed data are classified or analyzed using automated digital methods, and the output is transferred digitally into GIS.
4. Raw, digital remotely sensed data are entered directly into GIS, where all processing is done.

The best advantage of integration of remote sensing and GIS accrues from digital processing and transfer of data between the two systems (i.e., scenario 3

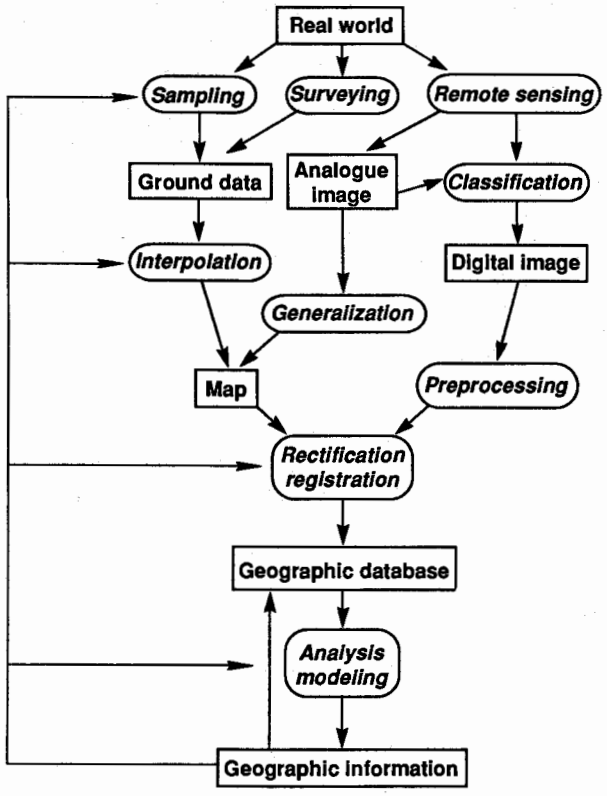

Fig. 5. Remote sensing as source of geographic information (Davis et al. 1991).

above). While much research has gone into digital processing of remotely sensed data, the stage of automated preprocessing, interpretation and analysis of raw digital imagery has not yet reached the level where the accuracy of the products can be routinely accepted into GIS. Much research work is still being focused on aspects of digital processing such as minimizing distortion and errors during data transformation, better automated techniques for interpretation, and improving classification accuracies (Davis and Simonett 1991; Davis et al. 1991).

Digital remotely sensed data are typically of the raster type. Use of remotely sensed data in GIS is better done in the raster mode, partly because vectorization of raster data does give rise to data integrity problems, and also because the raster data structure is more amenable to map overlay techniques, which are commonly employed for analysis of resource data generated from IPS. Hence, integration of remote sensing and GIS tends to favor the use of the raster data structure.

There are several advantages and opportunities in the combination of remote sensing and GIS in handling information for resource studies:

1. Remotely sensed data can be used as a quicker means of updating outdated maps, especially in cases where ground updating is slow or not forthcoming within the duration of the project.
2. The GIS database can provide ancillary data to assist in the classification or analysis of remotely sensed data, thereby improving the accuracy of the map product. For example, ancillary data on topography, geology, soils, etc., can provide vital clues for interpretation of vegetation cover rather than depending only on the spectral response information from remotely sensed satellite data.
3. Remote sensing is not an end in itself, but is the means to an end. Remotely sensed data are most useful in combination, either with geographic information from other sources, or when images of various dates and from different parts of the spectrum are put together. The GIS allows flexibility for such integration. At the same time, many GIS projects require data, especially good spatial, spectral and temporal coverages for analysis and modeling of complex real-world phenomena, and remote sensing sometimes offers a convenient means of obtaining such data.

While the advantages of integrating remote sensing and GIS may be recognized, both from the technical and cost-effective viewpoint, other non-technological considerations need to be addressed. Although the use of remotely sensed data can be cost-effective in the long run for large areal coverage, the technology may not be affordable to individual users or agencies employing them for specific areas and projects. In developing countries, few organizations have access to, or can afford IPS facilities. Those that operate on a commercial basis often charge very high fees for services rendered, whether to classify remotely sensed data or to convert them into GIS-compatible formats. There is a need for some organizational setup within the country or region to provide affordable "clearinghouse" services to small users, before the full potential of integrated remote sensing-GIS as a resource management tool can be realized (Simonett 1988).

Summary and Lessons Learned

With the advancement of computer science and rapid development of GIS technology, the integration of remote sensing and GIS provides a powerful system for resource management which can also be used for coastal zone planning and management.

Although there are two receiving stations for Landsat in ASEAN (Indonesia and Thailand), the use of remote sensing in resource assessment by ASEAN/US CRMP in the six pilot sites (see Chua, this vol.) was very limited. Possible reasons for this were cost, lack of familiarity with the methodologies and lack of technical expertise. In CRMP, only the Malaysian project was able to demonstrate the usefulness of GIS in integrating and analyzing multisectoral data. However, the continual use of the results and the database generated through the

Malaysian GIS study is hampered by the lack of institutional readiness and support to take over and maintain the system (Kam 1992).

Once implemented, a CZM plan is not expected to be static but will continuously evolve and be refined to meet the temporal and spatial changes in the management area. The use of remote sensing and GIS can readily respond to such changes once the database is established. Updating of the database can be accomplished using remotely sensed data while interactions or impact assessment of new changes/developments can be modeled through GIS, given new criteria or determinants.

The choice of suitable GIS for CZM planning depends on the kinds of applications and basic functions that are deemed most important and would be most frequently used. The lack of GIS specialists poses problems for wide adoption of the technology. Most often resource managers have understanding of tools such as GIS and remote sensing, but no working knowledge. The challenge lies with the user to be sufficiently familiar with GIS capabilities and to have a clear notion of the needs of the study.

With respect to applications, spatial analysis using GIS is generally context- and site-specific but the generic functions of GIS software make it possible to modify various criteria or determinants used (i.e., for resource evaluation and monitoring) to respond to the analysis required of a target area, be it land-based or in the coastal zone. In many cases, the constraint to application of GIS is due to data rather than methodology.

There is no doubt that the generic functions of GIS will expand to cover a wider range of applications. Applications for coastal zone studies including evaluation and management are now beginning. Recognizing the relative strengths and weaknesses of vector and raster data structures, most GIS systems are moving towards some form of "hybrid GIS" that offer combinations of vector and raster analytical capabilities. The GIS software development is also taking advantage of the swift progress in hardware technology, especially with respect to memory, storage and graphics capabilities, to offer increasingly user-friendly systems. The GIS market is now very competitive. Reduced cost of computers, particularly personal microcomputers with more powerful computing capabilities, and GIS software will make it possible for even small institutions to acquire such technology. To ensure the adoption of GIS technology, the institutional GIS framework must be established. This will pave the way for setting up mechanisms to maintain/update the system, improve the staff's GIS capability, respond to the corporate need for digital geographic information, and provide the necessary institutional and logistic support.

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A Framework for Rapid Appraisal of Coastal Environments*

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Abstract

Taking off from the concept and methodology of rapid rural appraisal (RRA) and allied modes of research, the rapid appraisal of coastal environments (RACE) attempts to expedite the coastal zone planning process. The RACE adopts or modifies RRA techniques to fast-track the diagnosis of coastal issues, arrive quickly at the subject areas for more rigorous research and facilitate the formulation of the management plan. The integration of exploratory, topical and monitoring RACE categories into the planning process is expected to provide reliable information in a fairly quick and cost-effective manner. Still, a distinct conceptual framework, practical methodologies as well as more concrete, sector-specific and transectoral data-gathering instruments need to be developed for a more effective RACE.

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*ICLARM Contribution No. 870.

Need for Rapid Appraisal of Coastal Environments

A major lesson learned from ASEAN/US CRMP is the need to expedite the planning process. The average preparation time for the CRMP coastal environmental profiles was about 1 year; detailed research was conducted for 2 years while the packaging of the site-specific management plans required roughly 2 years, for a total of approximately 5 years. Thus, procedures and techniques to fast-track the diagnosis of the coastal issues, arrive quickly at the subject areas for more rigorous research and facilitate the formulation of the management plans would be helpful.

In agriculture, a set of research techniques and survey instruments has been developed for the quick diagnosis of the rural environment--so-called RRA. In effect, RRA has emerged to fill the need in rural development for timely and usable information (Chambers 1980). McCracken et al. (1988) described RRA as a "semi-structured activity carried out in the field by a multidisciplinary team and designed to acquire new information on and new hypothesis about rural life".

While RRA as such formally started in 1978 during a workshop at the Institute of Development Studies, University of Sussex in the United Kingdom, the pioneering efforts can be traced back to the 1960s. Beebe (1987) suggested that RRA has conceptual and methodological similarities with other informal research methods such as informal agricultural survey, rapid reconnaissance, participatory rural appraisal and agroecosystem analysis. Some of RRA's features have been drawn from allied modes of research (e.g., systems orientation from agroecosystem analysis and farming systems research) which have led to the effective definition of the factors affecting and conditions of the agricultural environment. Hence, the minimum data requirements (both primary and secondary) for the conduct of an appraisal have been fairly standardized. The RRA is an avenue to acquire relevant and usable information about rural agriculture in a short span of time. The relative success of RRA in agriculture has led to its application to other sectors, e.g., forestry, urban slum areas, and recently, coastal environments.

RRA in Agriculture vs. Coastal RRA

Applications of RRA to agriculture utilize only certain key factors or conditions in the farm. Although the secondary data to be reviewed in agricultural RRA should cover socioeconomic, ecological and technical areas, Rhoades (1987) suggested that the information requirements may answer the following questions:

What are the agroclimatic zones?

What are the principal crops and cropping patterns?

What are the types of farm households?

What is the social organization of agriculture?
What are the farmers' practices?
Why do farmers follow these practices?
What do they feel are their main problems?

For upland agriculture RRA, Sajise et al. (1990) proposed a standard checklist of data to be obtained in the field. Table 1 shows the items in biophysical, socioeconomic or cultural categories. The do's and don't's in conducting interviews are more or less established: *do not* promise anything, *do* try to blend in with the community, *do* use open-ended questions to generate new information, etc. In the Philippines, the key informants for upland RRA are typically local community leaders, tribal chiefs, elders, model citizens and teachers.

The application of RRA in coastal areas is not well developed. In the Philippines, exercises in coastal RRAs were done in several provinces. In Malalison Island, Antique, RRA aimed to identify the resources of the coastal community and to undertake consultation (Bimbao and Dalsgaard 1991 and Siar 1992). The resources were identified and defined using coastal transects and resource mapping. In Guiwanon Island, Iloilo, the coastal environment was included in the investigation although the primary purpose of the RRA was to assess the potential of agroforestry (IESAM 1991). Here, the pattern of occupational activities for

Table 1. Checklist of field data to be gathered for an upland agriculture RRA.

Biophysical environment	Socioeconomic setting	Cultural setting
Land-use pattern	Demographic information	Migration and ethnic grouping
Soil fertility	Income sources (off-farm, on-farm)	Ethnicity and preferences for crops and livestock
Rainfall pattern	Labor availability and distribution	Leadership patterns
Availability of water supply	Transport facilities	Social structure as related to resolving conflicts and decisionmaking
Typhoon occurrence	Market and credit	Customs' and traditions related to agroforestry
Drought periods	Channels of market information	Organizations in the community, their roles and impacts
Land size	Cooperatives and other organizations	Social network
Cropping pattern/farming system	Land holdings and inheritance pattern	Rights and obligations with regard to sex, age and group
Availability of seeds, seedlings and animal stock	Land tenure status	Prevailing attitudes and beliefs
Dominant pests and diseases	Social services	Knowledge and skills in agroforestry and soil conservation
Topography, elevation and temperature range		Indigenous practices related to natural resource use
		Peace and order situation in the area
		History of the area

Source: Sajise et al. (1990).

fishing and the product flow for fish were determined through diagramming. An RRA training was conducted in Rapu-Rapu, Albay where coastal transects were prepared. In Malampaya Sound, Palawan, RRA focused on the coastal zone but the planning area included the adjoining watershed (Pido et al. 1990). The RRA intended to apply its terrestrial techniques in generating information and identifying problems and opportunities in the coastal areas. In all cases, the participatory approach and diagramming techniques of RRA were found useful. Intersectoral and transectoral issues, however, are prominent in coastal areas. As applications of RRA have been sectorally oriented, existing techniques and instruments focus on intrasectoral issues. The coastal application of RRA reviewed here all adopted existing RRA techniques. In Palawan, however, many RRA techniques (e.g., semistructured interviews [SSIs]) and standard data-gathering instruments (e.g., checklists) had to be significantly modified to deal with the complexity of the coastal zone.

The RRA was also applied in the appraisal of a fisherfolk community in Tamil Nadu, India (McCracken 1990) to determine its applicability in fisheries planning and development, but its outcome was mixed and inconclusive. Some participants commented that RRA was useful in doing comparative checks and in structuring data through ranking and diagramming. Others claimed, however, that the RRA team was too large for such a small fishing village, or the exercise was not helpful.

Research Techniques in RRA

McCracken et al. (1988) enumerated seven techniques that form the core of RRA; these can be used as part of more conventional research. The distinction between the two is that, to fast-track the analysis, RRA focuses on a narrower set of explanatory variables or key characteristics.

In fact, these techniques were all used by CRMP in its various surveys and research as shown in Table 2. *Secondary data analysis*, a standard research procedure, was used extensively to identify the data gaps and to define the management issues initially. *Direct observation* is fairly straightforward; field researchers note the field objects, events, processes and relationships.

The *SSI* employs informal, guided sessions where only some of the questions are predetermined and new ones or lines of questioning arise during the interview. The *SSIs* were widely applied in Lingayen Gulf, Philippines. *Analytical games* take various formats and were used in some countries as part of CRMP. Some games involve simple ranking to find out the preferences or priorities of certain groups or individuals.

Stories and portraits are colorful descriptions of situations recounted by the community members themselves. This technique was effectively resorted to by social scientists in Lingayen Gulf, where the fishers presented personal and historical anecdotes of their living conditions during informal gatherings.

Table 2. Techniques used in CRMP research and surveys.

Task code (Division)	Research/ management task	Research technique						
		Secondary data analysis	Direct observation	SSI	Analytical games	Stories and portraits	Diagrams	Workshops
100	Baseline information (Profiling)	x	x	x	sco	sco	x	x
200	Biogeographical studies	x	x	x	sco	nu	x	x
300	Socioeconomic studies	x	x	x	sco	sco	x	x
400	Legal/institutional studies	x	x	x	sco	nu	x	x
500	Rehabilitation and restoration	x	x	x	sco	nu	x	x
600	Resource management plan formulation	x	x	x	sco	nu	x	x

x - Used extensively.
sco - Some countries only.
nu - Not used.

Diagrams usually identify the four agroecosystem patterns: space, time, flow and decision. As part of the CRMP coastal transects (Fig. 1), seasonal calendars (Fig. 2) and flow diagrams (Fig. 3) were prepared.

Workshops, an ideal medium in bringing various people together, were widely used in CRMP, from the early phases of planning through the initial stage of plan implementation.

Key Questions on RACE

The CRMP lessons and experiences elsewhere, e.g., Palawan, Philippines (Pido 1992) reinforce the need to develop rapid appraisal specific to the coastal zone. The attempt to formulate a distinct coastal RRA has been called rapid appraisal of coastal environments (RACE). There are critical questions relating to the opportunities for and constraints to the application of RACE.

In what part of the planning process of integrated coastal zone management (ICZM) can RACE be most effectively used?

What will be the focus of RACE in terms of coastal conditions or factors to be examined?

What RRA techniques and instruments could be adopted or should be modified to fit into RACE?

What are the limitations of RACE?

RACE Framework

Fig. 4 presents an ICZM planning process combined with RACE. The planning process has eight sequential steps while RACE has three categories. The crux of the framework is complementarity. The RACE complements the ICZM planning

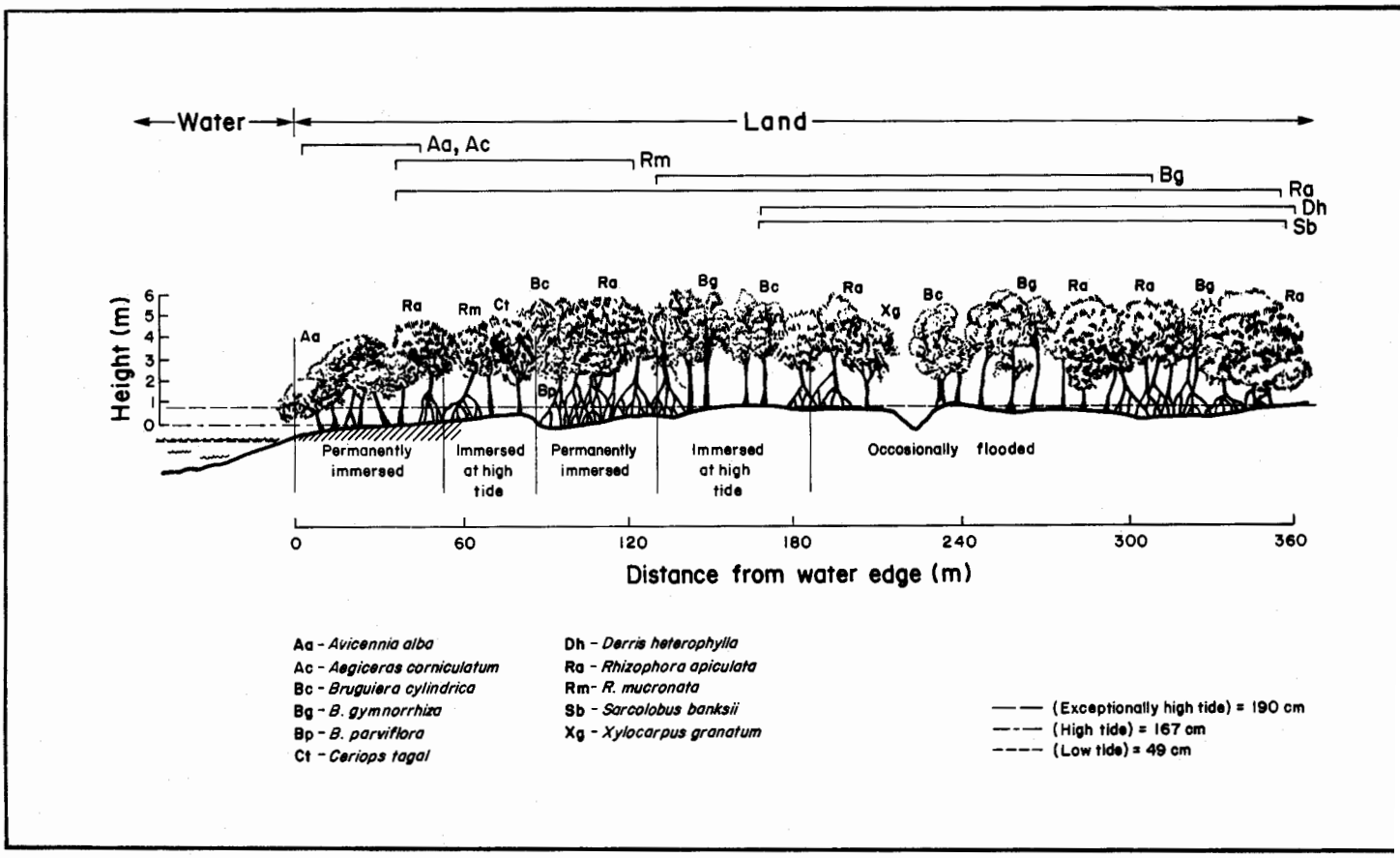

Fig. 1. A CRMP coastal transect (ET and Sujastani 1989b).

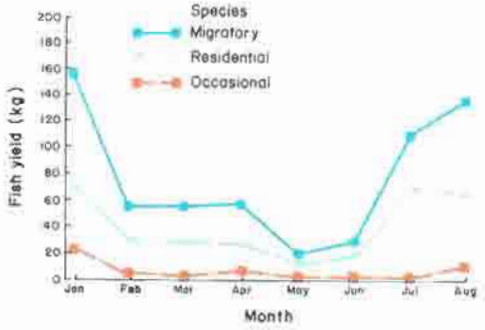

Fig. 2. A time pattern used by CRMP in Segara Anakan, Indonesia (ET and Sujastani 1989a).

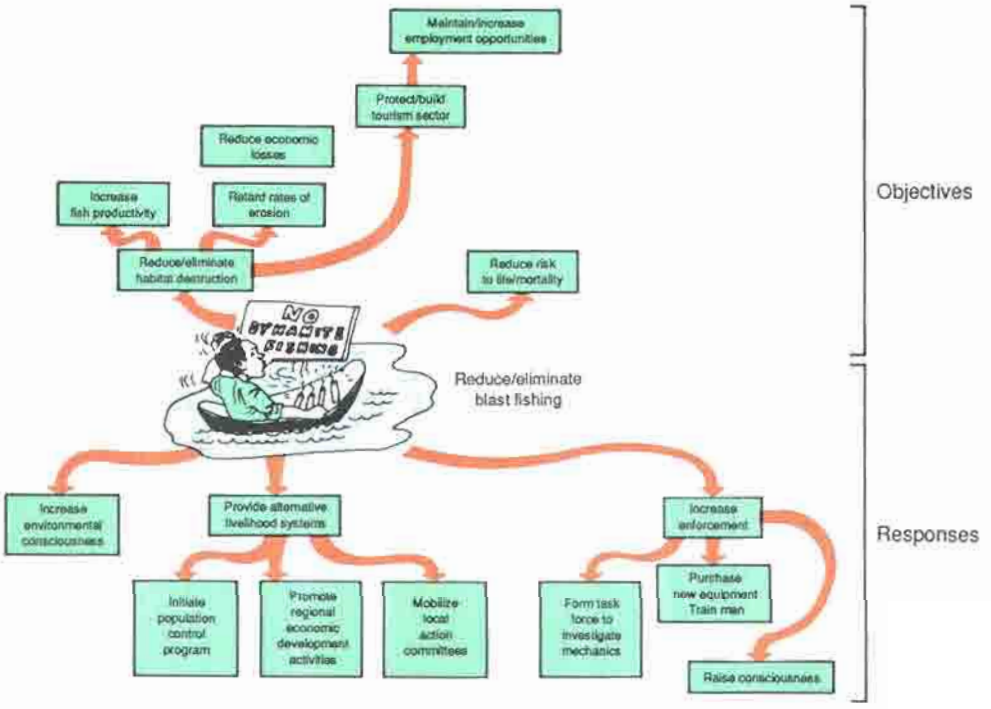

Fig. 3. Flow diagram (Dubois 1987).

process in preparing coastal environmental profiles and strategic/management plans. It is stressed that while RACE is desirable at certain stages, its output can never replace data generated through conventional research. Coastal zone planning can proceed without RACE but not the other way around. Hence, RACE is a package of techniques and instruments that will serve as a catalyst to coastal zone planning and management.

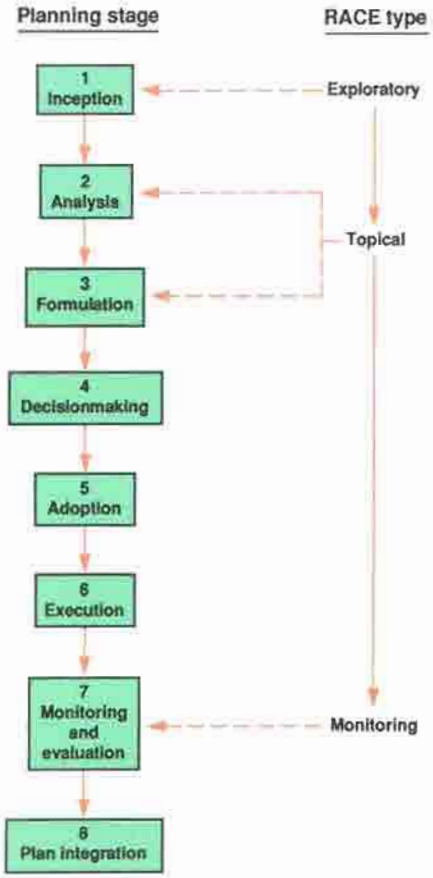

Fig. 4. An ICZM planning process combined with RACE.

McCracken et al. (1988) noted four major RRA categories: exploratory, topical, monitoring and participatory. Exploratory RRAs are used in the early stages of project planning to produce preliminary key questions and hypotheses for later testing. Topical RRAs investigate a specified topic often in the form of key questions and hypotheses generated by an exploratory RRA. Then, a detailed extended hypothesis is used as basis for research and development. Monitoring RRAs evaluate the success and impact of development activities. The output is usually a revised hypothesis or set of recommendations regarding the development intervention. Participatory RRAs involve the local communities in planning and research. The output is a farmer-managed trial or development activity that closely involves the villagers. These four RRAs, however, are not mutually exclusive and have varying degrees of overlap. The RACE adopts the first three categories: exploratory, topical and monitoring. Participatory RACE is subsumed in the three types because community involvement will be a built-in concern among all of these.

The three RACE categories are integrated at strategic points. Exploratory RACE seeks to hasten the analysis of management problems and issues during inception (Stage 1). Topical RACE attempts to verify the output of formal research during analysis and formulation (Stages 2 and 3). Monitoring RACE tries to assist the formal monitoring and evaluation (M&E) procedures (Stage 7) during plan implementation.

Table 3 presents the elements of an ICZM planning process with the RACE categories. In this proposal, each stage has distinct activities and outputs. The outputs of each stage, however, are prerequisites for the next one. Through RACE, it is estimated that the time frame can be shortened so that the combined planning process and RACE are expected to produce management plans within 1.5-2.5 years, a time savings of 2.5-3.5 years.

Inception (Stage 1) involves an interdisciplinary research team. The RACE facilitates the prognosis and diagnosis of coastal problems and opportunities through coastal diagrams depicting space, time, flow and decision patterns. There are two key outputs here. The first is the coastal environmental profile, which describes the environmental setting and makes a preliminary assessment of management issues. The other is the project workplan which proposes topics for research based on the data gaps identified. In effect, inception also establishes the planning/research direction.

Analysis (Stage 2) generates the necessary primary data identified in Stage 1. One major route is through formal research. For instance, detailed questionnaires can be used to collect socioeconomic data and marine species can be inventoried with standard transect methods. Similar to CRMP, the research shall be categorized into three major areas: biogeographical, socioeconomic and legal/institutional. The topical RACE (to be undertaken for some research areas, e.g., local communities' perception of the environment) may be pursued independently of the formal research. Nonetheless, its output will be used to verify or supplement the findings of the formal research. Formal research has quantitative and statistical precision while topical RACE is more focused on descriptive and qualitative data.

Stage 3, in effect, is program planning and project development. It may also be the phase where action plans (or sectoral plans as part of the overall plan) are prepared. The programs or functional components are essentially the set of projects and activities to be undertaken to achieve the objectives of the plan.

The next stage in which RACE can play a role is in the M&E of plan implementation (Stage 7). Monitoring is a "formative" function to see how the plan is moving and what changes are needed for better performance while evaluation is a "summative" function to distill the impacts of the plan and the lessons that can be learned (UNCRD 1980). The progress of implementation can be reviewed by either the formal M&E or the monitoring RACE.

Prospects and Challenges

There are many things to be done for RACE, from theoretical and methodological standpoints. The procedures, techniques and data-gathering instruments for RRA in agricultural contexts have been fairly well established. Those who conduct RRA in agricultural settings are already familiar with the minimum

Table 3. Elements of an ICZM planning process with RACE categories.

Planning stage (+ RACE)	Time frame (month)	Key activities	Key outputs
1. Inception (+ exploratory)	2-4	Define planning objectives	Set of planning objectives
		Analyze secondary data	Annotated summary to include: list of data gaps tentative list of problems outline of profile
		Undertake exploratory RACE to include: formulation of guide questions and initial hypotheses field trip, interview of key informants and primary data gathering	RACE report to include: analysis of space, time, flow and decision patterns network diagram of problems and their interrelationships with matrix of problems and strategies draft profile
		Prepare the coastal environmental profile	Profile to include: biophysical environment socioeconomic characteristics institutional/legal framework problems and opportunities
		Design the project workplan	ICZM project workplan which proposes topics for research; includes details like project objectives and targets, monitoring indicators tors, scheme of project management
2. Analysis (+ topical)	12-14 (2 months startup period to capture yearly variation)	Undertake topical RACE based on the result of exploratory RACE	RACE report
		Undertake formal research/survey based on the project workplan	Research/survey report must contain the analysis of issues, causes, impacts and constraints; estimates of products/services generated by the coastal resources; environmental impact assessment
3. Formulation (+ topical)	3-8	Prepare the strategic plan	Strategic plan with the following draft elements: coastal profile and issues, goals and objectives, policies and strategies, indicative programs and projects
		Formulate the management plan May conduct topical RACE to provide needed information	Management plan (in implementable form) has these elements with operational details: situational profile problems and opportunities philosophy, goals and objectives policies and strategies programs and projects organization and management M&E financial and economic justification
4. Decisionmaking	1-4	Submit the plan for adoption/ legitimization	Management plan is adopted or legitimized
5. Adoption	18th month	Pilot test the priority projects	Report on feasibility or applicability of projects
6. Execution		Implement the project activities as scheduled	Full-blown implementation of project activities
7. M&E (+ monitoring)		Assess the progress of plan implementation	M&E reports are regularly furnished
8. Plan integration		Integrate the plan at the regional/national level	Plan incorporated into the regional/national plans

secondary data required, the primary data sets to be generated from SSI and direct observation, the critical components of agroecosystems to analyze, and the diagrams to be prepared. This level of sophistication, however, has not yet been achieved in coastal zone planning.

Practical methodologies must be developed to speed up the analysis of secondary information. Table 4 proposes a diagnostic impact matrix to quickly appraise the effects of development activities on the coastal environment. This type of instrument has a number of uses. First, its quick identification of critical sites and activities delimits the planning area. This sets the physical boundary of data collection, thereby avoiding unnecessary information. Second, the matrix can facilitate identification of the appropriate sites for detailed survey. Given resource constraints, only representative sites within the planning area can be sufficiently covered on the ground.

More concrete, sector-specific and transectoral data-gathering instruments also need attention. For instance, what sort of questionnaire would be appropriate for an SSI with an artisanal fisher versus a commercial fisher? What types of questionnaires would be suitable for various entrepreneurs in the coastal zone, e.g., tourist developer or industrialist? Checklists for direct observation should be refined, too. Table 5 lists key indicators to be annotated when conducting a reconnaissance survey. This would expedite the preparation of questionnaires or formulation of in-field hypotheses.

There are also important areas for research. One is the identification and definition of the systems elements of RACE. In agricultural RRA, agroecosystem analysis has become a cornerstone (Conway 1985). The coastal RRA experience in Palawan suggests that agroecosystem analysis has limited applicability in coastal zone planning (Pido 1992). This is because the coastal zone system is much more complicated than a typical farm or other natural systems such as a lake or a catchment. Sorensen and McCreary (1990) identified at least nine major systems that affect coastal management. Diverse economic activities occur in the coastal zone, particularly human settlement, agriculture, shipping, fisheries, tourism and industry. In addition, the level of governance in the coastal zone is extremely complex, ranging from private ownership through traditional-use rights to public control. The above argument reinforces the need for RACE to be built on a distinct conceptual framework which recognizes the complexities and interconnections in coastal areas.

Moreover, in many coastal areas of the developing world, there are rarely sufficient time and resources to allow a comprehensive analysis of coastal conditions. Hence, there must be practical ways to obtain some of the desired data in a fairly quick and cost-effective manner. The RACE is envisaged to play a crucial role in providing timely and reliable information to the coastal managers for better decisionmaking. Some critical management questions in the coastal zone do not require formal planning or elaborate research.

What activities affect critical habitats?

Table 4. Diagnostic impact matrix of development activities on the coastal environments.

Activity[1]	Socioeconomic factor		Ecosystem/habitat[2]										Oth
	Income	Employ-ment	Marsh	Delta	Estuary	Mangrove	Seagrass	Coral reef	Beach	Island	Coastal forest	Coastal waters	Man-made structures
A. Agriculture													
Upland cultivation													
Irrigation													
Fertiiizer/pesticide use													
Animal husbandry													
Lowland cultivation													
B. Fisheries and aquaculture													
Trawling													
Purse seining													
Fry gathering													
Explosive fishing													
Cyanide fishing													
Muro-ami													
Pond construction													
Mangrove clearing													
Coral mining													
Cage/pen culture													
Saltmaking													
C. Infrastructure													
Roads													
Bridges													
D. Mining													
Sand and gravel													
Other minerals													
E. Ports and harbors													
Construction													
Dredging													
Waste disposal													

Table 4 (continued)

Activity[1]	Socioeconomic factor		Ecosystem/habitat[2]										Oth
	Income	Employ-ment	Marsh	Delta	Estuary	Mangrove	Seagrass	Coral reef	Beach	Island	Coastal forest	Coastal waters	Man-made structures
F. Industry													
Construction													
Waste disposal													
Drilling/dredging													
G. Tourism													
Boating/anchoring													
Diving													
H. Urban development													
Solid waste disposal													
Liquid waste disposal													
Residential expansion													
Power plants													
I. Forestry													
Fuelwood gathering													
Mangrove harvesting													
Logging													
J. Shipping													
Tankers													
Passenger boats													
Cargo boats													

Impact code: H-High; M-Medium; L-Low/Positive (+); Negative (-).
Note: Using collective expert judgment, the appraisal team shall assess the impact of the activity. For instance, if dynamite fishing has high negative impact on coral reefs, its rating on that item will be
[1]Modified from ADB (1991) and Chua (1987).
[2]Adapted from Maragos et al. (1983).

Table 5. List of indicators based on visual assessment to be annotated during a reconnaissance trip.

Indicators	Annotation by village/transect line 1	2	3	4	5	6
A. Biophysical[1]						
1. Erosion						
2. Grassland						
3. Fruit-bearing trees						
4. Color of river						
5. Color of sea*						
6. Waterways						
7. Wildlife						
8. Crop varieties						
9. Domesticated animals						
10. Cropping pattern						
11. Soil appearance						
12. Boats						
powered						
nonpowered						
13. Fishing*						
14. Aquaculture*						
B. Socioeconomic[1]						
1. Appearance of children						
2. Diseases						
3. Types of houses						
4. Appliances and toys						
5. Checkpoints						
6. Church/temple/mosque						
7. Nongovernmental organizations						
Private voluntary organizations						
8. Community meetings						
9. Schools/enrollment						
10. Leaders without bodyguards						
11. Foreigners/tourists*						
12. Mode of transport*						
13. Road network condition*						
14. Potable water*						
15. Communication system*						
16. Fish in the market*						
17. Fighting cocks*						
18. Gambling dens*						
19. Idle people*						
20. Heavy industries*						
21. Commercial establishments*						
22. Cottage industries*						
C. Ecological[2]						
1. Marsh						
2. Delta						
3. Estuary						
4. Mangrove						
5. Seagrass						
6. Coral reef						
7. Beach						
8. Island						
9. Fish						
freshwater						
brackishwater						
marine						
10. Pollutants*						
domestic waste						
industrial waste						
solid waste						
hazardous waste						

[1]Adopted from Sajise et al. (1990) except*.

[2]Adopted from Maragos et al. (1983) except*.

Note: Some indicators may be given qualitative remarks: others may simply adopt the following codes: S = significant; P = present; NS = not significant.

What is the prevailing organizational structure among the competing sectors?

What are the general sentiments of artisanal fishers about the encroachment of trawlers?

The quick generation of usable information for such planning and research concerns is where RACE is anticipated to serve best.

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Economic Valuation: Available Methods*

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Abstract

Economic analysis of alternative coastal resource-use scenarios often requires nonmarket valuation, i.e., valuation of commodities not traded in competitive markets (e.g., onsite and offsite benefits of a mangrove). Designed to identify, quantify and monetize the environmental impacts of projects or policies, current methods of nonmarket valuation include generally and potentially acceptable, and survey-based methods. Generally acceptable methods use market prices or productivity directly to value coastal resource-use impacts. Potentially acceptable methods use market prices or depend on estimates of potential expenditures to value an unmarketed quality of the environment. Survey-based methods obtain information through questionnaires or experiments. All these valuation methods can assist decisionmakers in achieving economically efficient coastal resources management (CRM).

Introduction

The coastal area is characterized by multiple resource systems and multiple users. Small-scale fishers may exist side by side with industrial development

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and resort and tourism-based activities. Land-based activities, such as logging and agriculture, may impact upon marine-based resource systems and activities, such as coral reefs and tourism. Competition for resource use among multiple users inevitably leads to conflict. If left unmanaged, competition among resource users may result in overexploitation of a resource, negative environmental effects, equity problems with income generation and distribution, and loss of social welfare (Dixon 1989).

Information is needed by decisionmakers to evaluate the tradeoffs between alternative development and resource-use scenarios. Economic analysis can help identify the winners and losers, and the benefits and costs associated with a decision on coastal resource use. While most decisions are frequently made at the political level, economic analysis can serve as a framework to identify and organize economic, social, cultural, political and ecological information to improve the decisionmaking process (Agüero 1989).

Economic analysis of alternative coastal resource-use scenarios often requires valuation of commodities not traded in competitive markets. This valuation process is termed nonmarket valuation. Rather than financial prices, shadow prices are used that reflect opportunity cost, including valuation of externalities wherever possible. The cost and benefit streams are compared and indicators such as net present value (NPV) and internal rate of return are calculated. Because of unfamiliarity with nonmarket valuation theory and techniques, many may view these with confusion and suspicion. This paper presents a brief theoretical basis for nonmarket valuation, summarizes current nonmarket valuation techniques and presents a case study of its use in CRM.

Coastal Resource Use

The ASEAN member-countries contain diverse and valuable coastal resource ecosystems, which do not exist in isolation. These ecosystems are interrelated and interdependent and often have direct or indirect connections with land-based ecosystems. Consequently, development activities that affect one natural system may also affect other ecosystems adjacent or some distance away. Thus, the disturbance of an upland forest can result in adverse effects on an estuary or a coral reef downstream from the watershed. The destruction of a marsh or of a mangrove forest may affect fisheries production adversely some distance away.

Coastal resources provide valuable goods and services for human use. Some of the resources are living, others are inanimate. Some of the goods and services are valued and traded in the marketplace, others are not.

Marketed goods are tangible items that can be enumerated and have a price. Mangrove poles, crabs, fish, sand, salt and petroleum are all examples of mar-

keted (or marketable) goods. Services are often less tangible or, in some cases, harder to value. For example, the nutrient flow of detritus from a mangrove ecosystem is an important part of the food cycle of many fish and arthropods such as crabs and shrimp. Although not sold in the market, this nutrient flow is a valuable resource that directly affects the productivity of other, marketable coastal resource products (i.e., crabs and shrimp). Beaches, coral reefs and a clean environment provide important recreational and tourist services sold indirectly via supporting infrastructure (hotels, restaurants and dive companies). Although nonmarketed goods and services contribute to social welfare just as more easily valued, marketed goods, they tend to be overlooked or ignored in the analysis of options. A mangrove area, for example, may be analyzed as a site for a new shrimp farm. If the "value" of the mangrove is calculated based solely on the poles and charcoal produced, it will have a low value per hectare. If, however, the other onsite and offsite benefits of a mangrove are included, it will be seen as an ecosystem of considerable value (Dixon 1989). As Dixon (1989) states:

> Whether a coastal resource is a good or service, marketed or nonmarketed, is not important in terms of its function in the coastal ecosystem. The extent to which coastal resources represent easily marketed goods, however, heavily influences resource management decisions. Nonmarketed goods and environmental or ecosystem services are frequently overlooked or their importance played down. This is one of the factors leading to resource management conflicts and poor decisions.

Coastal zone resources frequently require intervention by government or other institutions to solve conflicts and guide use patterns. In economic terms, a market failure exists, and, left to purely market (or political) forces, a suboptimal allocation of resources will occur. This is particularly true if one is concerned with social welfare and long-term sustainable CRM. All of the market signals (and imperfections) favor rapid development and overexploitation of coastal resources. These patterns can be the result of very different reasons. Poverty-driven overexploitation by large numbers of coastal residents can be just as destructive as greed-driven resource use by a handful of wealthy and powerful people. In both cases, the results are similar--short-run benefits are extracted at the cost of larger, long-run returns. In economic terms, this is the challenge of CRM.

Management of resource use is never easy. It requires change and it will produce winners and losers. Management, therefore, requires identification of impacts, assessment of benefits and costs, and analysis of alternatives. In addition, one has to deal with questions of equity: who wins, who loses and what happens to the resources available for the next generation? Economic analysis can provide a framework for this management analysis.

What is Economic Value?

Economics is the study of human choices–of how people allocate resources among competing alternative uses to maximize their own well-being. Therefore, by observing the choices people make, economists can determine the relative value to people of different goods, services and resources (hereafter referred to as products). Economists are often able to rely on market prices when determining economic values as revealed by people's resource allocation choices. Within well-functioning markets, sellers and buyers exchange money for products. The amount of money that must be exchanged for each unit of a product is its market price. In a market, buyers are willing to pay money for a product if they value that product more highly than other products which may be purchased for the same money. Conversely, sellers will sell the product for money if they value the other products the money could buy more highly than the product being considered for sale. The price at which the product is voluntarily exchanged is, therefore, a basis for measuring the value of the product to the buyer; it can also reflect value to the seller since the market price cannot fall below the value to the seller. Thus, market prices are not arbitrary, rather they reflect the value of the product in question to buyers and sellers. Furthermore, in a well-functioning market, prices reflect marginal value, i.e., they reflect the value of the last unit of product traded.

To determine total economic value of all the units of product traded, the analyst must use the concepts of economic surplus; specifically, total economic value is not equal to market prices paid for a product. Although there are some buyers who would be willing to pay more than the market price for a product traded, they do not have to--they are able to obtain the product at the market price. Conversely, there are some sellers who would be willing to accept less for the product than the market price. The difference between what each buyer pays for a product and what each buyer would be willing to pay is consumer surplus. The difference between the market price the seller receives and what he would be willing to sell the product for is economic rent. These areas of economic surplus (consumer surplus plus economic rent) can be seen in the standard demand and supply diagram of Fig. 1, where d' is the demand curve for the product and s' is the product supply curve.

The demand curve is a locus of price and quantity data points. Since price equals marginal value for the last unit traded, the demand curve also approximates a revealed marginal valuation curve of consumers for the product. For sellers, the supply curve represents the cost of offering one more unit of the product for sale. In this context, cost is the return that the resources used for producing X would have earned if devoted to producing a product other than X.

In Fig. 1, the market price for X_1 is P_1 and all units of X will trade at P_1. Therefore, the total revenue earned by sellers of the X_{1st} unit to both buyers and sellers is equal to P_1, the value of total output OX_1 to buyers and sellers differs from the

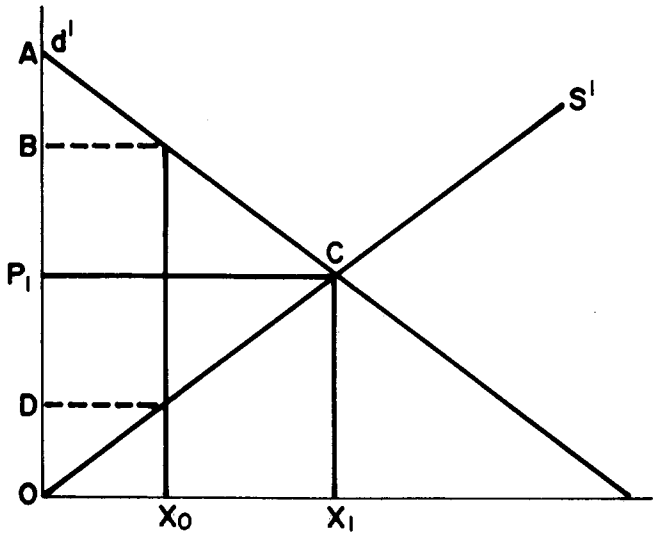

Fig. 1. Demand and supply for product X.

market revenue of OP_1CX_1. To see this, consider X_{0th} unit. For the unit, sellers receive P_1, but the costs of production for that unit are OD. Since costs represent the returns of the resources used to produce X_0, if they had been devoted to some alternative use, the distance P_1D is a surplus (economic rent) to the factors of production when these resources are used in the production of X rather than alternative production. For consumers, some would be willing to pay OB for the X_{0th} unit but only need to pay OP_1, and would earn a consumer surplus of P_1B. Thus, the economic value of OX_1 is the sum of all consumers' surpluses and rents, the area OAC. This economic value is not equal to the total market revenue OP_1CX_1 (Batie and Shabman 1982; Waters 1985). (This is a relatively simple description of consumer surplus and economic rent. For a more complete understanding of the theoretical foundations of these measures, see Mishan 1981.)

Because of rents and consumer surplus, an accurate measure of economic value must be extended beyond simple observations of market prices to consider the demand and supply functions for the product. However, demand and supply functions for products revealed through market exchange cannot be a basis for establishing value if the exchange process is flawed--as is often the case for some coastal resources such as mangrove areas and the services they provide. For example, the values of the many ecological services of mangroves are not considered by either the buyer or the seller in a market transaction. Because property rights for these ecological services are ill-defined and because costs of transacting between owners of mangroves and beneficiaries of ecological services are high, there are no markets where owners of mangroves can sell ecological services to willing buyers. As a result, the market price for mangroves will not reflect the

value of these ecological services. Thus, when mangroves are developed, it will be with little or no recognition by the private buyers and sellers of the value of the ecological services foregone.

When market prices cannot be used to construct appropriate money value measures because the exchange process is flawed, the economic analyst must develop "shadow values" for the services of the resource system, such as mangroves. A shadow value should be based upon the demand and supply curves which would have been revealed by people buying and selling the resource and its services in a market, if such a market were able to function under theoretically ideal conditions.

Prices for products in a well-functioning market are a money measure of the subjective value buyers and sellers place on those products. Thus, the search for shadow prices for nonmarket services (such as mangrove services) is a search for a measure of people's values for those products. These values are, of course, based upon the preferences and knowledge of the current population. People's values may change over time as they gain knowledge about the importance of certain products (such as coastal resource systems) and, as a result, they may be willing to pay more of their money income for the services of the natural resources relative to other goods. As this occurs, shadow prices can be expected to rise. Nevertheless, the economic analyst accepts the existing structure of individual human values as the basis for calculating shadow prices.

Dixon (1986) has identified a four-step assessment and valuation process. First, the important environmental effects have to be determined. Next, the effects have to be quantified. These quantified changes must then be valued and monetary values placed on them. Economic valuation will be the topic of the next section of this paper. The actual economic analysis is the last step; usually taking the form of cost-benefit analysis.

Cost-benefit analysis is the general analytical framework of identifying and measuring the economic benefits and costs of a project or program. The benefits of a project are the values of incremental outputs of products, including environmental services, made possible by the project. The costs are the values of the incremental real resources used by the project. Both project costs and benefits are appropriately discounted over time to make them commensurate. The baseline usage would be the status quo. That is, the area would remain in its current natural or partially developed state. The alternatives identify the various development projects being considered.

In general, both preservation and development yield several services, each of which must be evaluated. An appropriate strategy is to divide the overall problem into an evaluation of as many mutually exclusive services as possible. These subproblems are indicated as individual accounts within the appropriate column (Table 1). For example, the provision of mangrove habitat is one preservation service which can be subdivided further into an evaluation of its contributions to fisheries, fuels and construction materials (Waters 1985).

Table 1. Cost-benefit analysis.

Discounted net benefits of preservation (P)	Discounted net benefits of development (D)
Commercial fishing	Condominiums
Recreational fishing	Marinas
Hunting	Residential lots
Waste assimilation	Industrial/commercial
Etc.	Etc.
Total P <--Compare-->	Total D

Each independent evaluation should proceed according to the "with and without" principle (Batie and Shabman 1982). If there are no substitutes for the mangrove services, for example, then the value of the mangrove is determined as the difference between the economic surpluses generated with and without a small change in mangrove area. If, however, there are substitutes, then the value of the mangrove is the lesser of (1) the direct value of services produced by the mangrove (as measured by the "with and without" principle) or (2) the cost of substitutes capable of producing equivalent services. Substitutes for mangroves include technological substitutes such as fish hatcheries or aquaculture, flood protection and construction of new mangroves.

The procedures for determining the value of mangroves, for example, in its unaltered and developed states are analogous. The value of mangrove areas for development is the difference between the economic surpluses generated with onsite development and its economically feasible substitute. Substitutes include a more costly development plan with less environmental damage and development of an alternative site.

Both preserved and developed areas yield benefits over time, in which case the economically preferred use yields the largest NPV. This can be expressed by using the simple equation:

$$NPV = Bd + Be - Cd - Cp - Ce$$

where

NPV = net present value
Bd = direct project benefits
Be = external (or environmental) benefits
Cd = direct project costs
Cp = environmental protection costs
Ce = external (or environmental) costs

All B and C items are discounted to present values.

The choice of the discount rate to be used in the discounting is both controversial and important. The present value formula creates a weighted sum of the annual benefits. The weighting factors, determined by the discount rate, decline exponentially over time. Therefore, resource uses which would yield large benefits in the distant future would be favored with low discount rates, while uses which would yield large benefits in the present and near future would be favored with high discount rates. In general, development projects exhibit fast payoffs; these would be favored with high discount rates. Preservation may yield relatively low benefits over a long period of time and, hence, would be favored with low discount rates.

Projects and policies alike involve risks and uncertainties. Risks are involved when probabilities can be assigned to the likelihood of an event, such as an industrial accident, to occur. Uncertainty describes a situation where little is known about future impacts and where, therefore, no probabilities can be assigned to certain outcomes, or where even the outcomes are so novel that they cannot be anticipated.

Risk can be insured against as a cost, but uncertainty defies actuarial principles because of uniqueness of outcomes. The proper response to risk is to count it as a cost in expected value formulations. The proper response to uncertainty is likely a policy of general caution--if one cannot see very far ahead, slow down (Munasinghe and Lutz 1991). (For details on the mechanics of cost-benefit analysis, especially for environmental decisions, see Hufschmidt et al. 1983; Dixon and Hufschmidt 1986; and Dixon et al. 1988.)

Valuing the Impacts in Economic Terms

A number of conceptual methods and techniques have been developed to value coastal resource-use impacts. An impact can show itself in a measurable change in production or in environmental quality. Depending on the type of impact, different methods are appropriate.

A topology developed by Dixon et al. (1988) arranges these methods into three categories based on applicability. The main methods and approaches discussed below are generally or potentially applicable in developing countries. The techniques are presented in decreasing order of reliance upon market information, beginning with those that rely on market prices and ending with survey-based methods (Table 2).

Generally applicable methods

Generally applicable methods are directly based on market prices or productivity. This is possible where a change in resource use affects actual production

Table 2. Measurement and valuation techniques.

Methods		
Generally applicable	Potentially applicable	Survey-based
Those that use the market value of directly related goods and services • change in productivity • loss of earnings • opportunity cost	Those that use surrogate-market values • property value • wage differential • travel cost • marketed goods as proxies	Contingent valuation
Those that use the value of direct expenditures • cost-effectiveness • preventive expenditures	Those that use the magnitude of potential expenditures • replacement cost • shadow project	

or productive capability. The first deals with changes in productivity and the value of output; the second with loss of earnings; and the third with the opportunity cost of different actions.

Change in Productivity. Development projects can affect production and productivity positively and negatively. A fisheries management project involving effort reduction measures, for example, can lead to a higher catch output than would be the case in the "without project" situation. The incremental output can be valued using standard economic prices. The environmental costs of reclaiming mangroves are now being recognized. Where these affect the fish catch either in the short- or long-run, the value of the catch can be estimated directly by using actual or projected market prices.

Loss of Earnings. Changes in resource use and environmental quality can have significant effects on human health. The monetary value of health impacts should be determined by the individuals' willingness to pay for improved health. In practice, one may have to resort to "second-best" techniques such as using foregone earnings through premature death, sickness or absenteeism; and increased medical expenditures. This approach may be relevant, for example, when considering water pollution safety. Thus, the lost earnings that result from environmental damage caused by a project, or the comparable savings which would accrue from preventing that damage, become the standard of valuation.

Opportunity Cost. This approach is based on the concept that the cost of using resources for unpriced or unmarketed purposes can be estimated by using the foregone income from other uses of the resource as proxy. Rather than attempting to measure directly the benefits gained from preserving a resource for these unpriced or unmarketed purposes, we measure what has to be given up for preservation. The opportunity cost approach is, therefore, a way of measuring the "cost of preservation". This information, in turn, is used to evaluate the

options open to a decisionmaker. There are many instances where the opportunity cost of preservation is found to be low, resulting in a decision to preserve or to conserve the resource in its natural state.

The final two generally applicable techniques rely on the use of market prices to evaluate costs that are actually incurred. This includes cost-effectiveness analysis and the technique of preventive expenditures. Note that neither approach attempts to estimate a monetary value for the benefits produced by the project. The project output or product is described in qualitative or physical terms. For both sets of cost-side approaches, therefore, the analyst must determine that the potential benefits justify the costs involved.

Cost-effectiveness Analysis. When funds are limited, data inadequate, or the level of knowledge insufficient to establish the link between environmental damage and human health and welfare, it may sometimes be more useful first to set a goal and then analyze different means of achieving it. Conversely, if there is a certain level of funding available for a given project, then the policymaker must decide which method of using those funds will be most effective. Alternately, it might be necessary to consider a number of goals and to decide which of them seems best after considering the cost of each. In all these situations, cost-effectiveness analysis is involved. The major difference between it and other approaches is that no attempt is made to monetize benefits. Rather, the focus is entirely on meeting a predetermined standard or goal.

Preventive Expenditures. Individuals, firms and governments undertake a variety of "preventive expenditures" to avoid or reduce unwanted environmental effects. Environmental damages are often difficult to assess, but information on preventive expenditures may be available or can be obtained at lesser cost than direct valuations of the environmental good in question. Such actual expenditures indicate that individuals, firms or governments judge the resultant benefits to be greater than the costs. The preventive expenditures can then be interpreted as a minimum valuation of benefits. However, caution is advisable especially in cases where preventive expenditures are arbitrarily mandated by governments, having little or no relationship to market forces or free choices by informed economic agents.

Potentially applicable methods

Potentially applicable methods use market information indirectly. They are called "potentially applicable" because they need greater care in their use, making more demands on data or on other resources, or because they require stronger assumptions than the more directly operational techniques. The first group of techniques use surrogate-market techniques which make use of an actual market price with which to value an unmarketed quality of the environment. This includes property value, wage differential, travel cost and marketed

goods as proxies. The second group utilizes cost-analysis techniques which depend on estimates of potential expenditures to value a development impact on the environment. Each measure examines the costs that would be involved if some impact on the environment were to be mitigated by replacing the services which had been damaged or destroyed. This information is then used to decide whether it is more efficient to take preventive measures beforehand or compensatory measures after the event. This includes replacement cost and shadow project.

Property Value. This approach is also referred to as the hedonic price technique and it is a subset of the more general land value approach. The objective here is to determine the implicit prices of certain characteristics of properties. In the environmental area, the aim of the method is to place a value on the benefits of environmental quality improvements or to estimate the costs of a deterioration. The approach is based on the assumption of a competitive real estate market, and its demands on information and statistical analysis are significant; therefore, applicability to developing countries is limited.

Wage Differential. This approach is based on the theory that in a competitive market the demand for labor equals the value of the marginal product and that the supply of labor varies with working and living conditions in the area. A higher wage is, therefore, necessary to attract workers to locate in polluted areas or to undertake more risky occupations. Again, as in the case of the property value approach, the wage differential approach can only be followed if the labor market is very competitive. Also, the approach only reflects private valuation of health risks, but not social ones.

Travel Cost. This approach is most often connected with recreational analysis in industrial countries, where it can serve to measure the benefits produced by recreation sites (parks, lakes, forests and wilderness). Essentially, the same approach can also be used to value "travel time" in projects dealing with fuelwood and water collection.

The surrounding area of a site is divided into concentric zones of increasing distance. (Visiting the various zones involves different travel costs.) A survey of users, conducted at the site, determines the zone of origin, visitation rates, travel costs and various socioeconomic characteristics. Users close to the site would be expected to make more use of it, because its implicit price, as measured by travel costs, is lower than for the more distant users. Based on the analysis of the questionnaires, a demand curve can be constructed and the associated consumers' surplus determined. This surplus represents an estimate of the value of the environmental good in question.

Marketed Goods as Proxies for Nonmarketed Goods. There are situations where environmental goods have close substitutes which are marketed, and where, therefore, the value of the environmental good in question can be approximated by the observed market price. For example, the value of a nonmarketed fish

variety can be valued at the price of the most similar fish being sold in local markets.

Sometimes it is not possible to estimate the benefits of environmental quality protection or improvements. In some of these cases it may be possible to estimate benefits by calculating the costs of replacing the environmental services that have been or might be destroyed by the project. Once again, however, great care needs to be taken to avoid improper valuation.

Replacement Cost. Under this approach, the costs that would have to be incurred to replace a damaged asset are estimated. The estimate is not a measure of benefit of avoiding the damage in the first place, since the damage costs may be higher or lower than the replacement cost. However, it is an appropriate technique if there is some compelling reason as to why the damage should be restored, or certainty that this will occur. An example of the use of this technique would be the cost of an artificial fish nursery to estimate the value of mangroves that might be impaired by a project.

Shadow Project. When evaluating projects that have negative environmental impacts, this approach involves the design and costing of one or more shadow projects that provide for substitute environmental services to compensate for the loss of environmental assets under the ongoing projects. This approach is essentially the same as the replacement cost approach and is increasingly being mentioned as a possible way of operationalizing the concept of sustainability at the project level. It assumes that there is a constraint to maintain environmental capital intact, and, therefore, could be most relevant when "critical" environmental assets are at risk.

Survey-based methods

Survey-based methods are used to value the environmental impacts of development projects in the absence of data on market or surrogate-market prices. The contingent valuation method will be discussed.

Contingent Valuation. In the absence of people's preferences as revealed in markets, the contingent valuation method tries to obtain information on consumers' preferences by posing direct questions about willingness to pay. It basically asks people what they are willing to pay for a benefit, or what they are willing to accept by way of compensation to tolerate a cost. This process of "asking" may be either through a direct questionnaire/survey or by experimental techniques in which subjects respond to various stimuli in "laboratory" conditions. Sought are personal valuations of the respondent for increases or decreases in the quantity of some goods, contingent upon a hypothetical market. Willingness to pay is constrained by the income level of the respondent, whereas willingness to accept payment for a loss is not considered. Estimates of willingness to accept tend to be several times willingness-to-pay estimates.

Pearce and Markandya (1989) compared the contingent valuation method with other, more market-based methods and found that in seven studies done in industrial countries the overlap of estimates is complete, if accuracy is expressed as plus or minus 60% of the estimates computed. This result provides some reassurance that a rigorously applied contingent valuation method, while not being very precise, nevertheless can produce valuations that are of the right order of magnitude. This may be sufficient to rule out certain alternative projects or favor others, which can be valuable in decisionmaking.

The contingent valuation method has many shortcomings, including problems of designing, implementing and interpreting questionnaires. While its applicability may be limited, there is some experience with applying this approach in developing countries (see Whittington et al. 1989; Munasinghe 1990).

In certain circumstances, this may be the only available technique for benefit estimation, which has been applied to common property resources, amenity resources with scenic, ecological or other characteristics, or other situations where market information is not available. Caution should be exercised in seeking to pursue some of the more abstract benefits of environmental assets such as existence value (of an asset which may never be used but promises psychic satisfaction merely because it exists).

The approaches and techniques described above are designed to help those planning projects or policies to identify, quantify, monetize and include the environmental effects of their projects or policies. Some of these techniques are easily applied to developing countries, while others demand more in the way of time and data, if applicable at all. Although the approaches and techniques presented here are theoretically well founded, there are limitations to the economic measurement of development and environmental effects in general, and specifically to the use of cost-benefit analysis for this purpose. Some of the issues are controversial and raise important ethical questions. Others raise intractable questions of measurement. These issues of project effects include income distribution, intergenerational equity, risk and uncertainty, irreversibility of habitat alteration, value of human life, incrementalism (problems which arise from making decisions on an individual project basis without consideration of the cumulative effect of many such decisions), and cultural, historical and aesthetic resource alterations. If not perfect, however, where economic valuation fails to completely capture certain impacts on the environment, these impacts may at least be included qualitatively in the project analysis.

Summary

Due to the multiplicity of uses and potential conflicts which may arise as a result of alternative uses, criteria and techniques to choose among them are needed. Economic analysis and valuation methods applied to coastal resources

provide useful information for policy decisionmaking. Economic analysis can assist decisionmakers in achieving economically efficient management of natural resources.

Although some economic valuation techniques have been successfully used in the developing-country context, their application to coastal resources and their experience in use is only recent. Experience in use continues to accumulate. The best one can do, however, is to use cost-benefit analysis and economic valuation techniques to the extent possible and push their limits. The methods are not without problems and further applications in developing countries and in a coastal context are needed. Whether or not market or surrogate market prices can be estimated, cost-benefit analysis provides a useful framework for policy decisionmaking. Whether the benefits of a project are more than the costs and what alternative strategy may produce better results, can be determined, in part, through cost-benefit analysis.

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Appendices

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Program of Activities

Tuesday, April 28
Riverview Inn, Bandar Seri Begawan
A.M.

Registration
Welcome Address: *Pg. Sharifuddin bin Pg. Haji Yusof*
Opening Addresses: *Dr. Kenneth T. MacKay* and *Mr. Robert Dakan* (read by *Dr. Chua Thia-Eng*)
Keynote Address: *Dato Paduka Malai Ali bin Malai Haji Othman*

Session 1: Integrated Coastal Zone Management Concept and Planning
Chairperson: *Dr. Rafael D. Guerrero III*
Rapporteur: *Mr. Geronimo T. Silvestre*
The Concept of Integrated Coastal Zone Management. *Dr. Chua Thia-Eng*
Planning and Management Approach in Integrated Coastal Zone Management. *Mr. Leonardo Quitos* and *Mr. Cesar Z. Luna*
The ASEAN Experience in Integrated Planning of the Coastal Zone: Towards a More Practical Approach. *Dr. Chua Thia-Eng* and *Mr. Michael Pido*
Legal and Institutional Considerations in Coastal Resources Management: An ASEAN Perspective. *Dr. Richard Tobin*
Discussion
Discussants: *Dr. Jahara Yahaya, Dr. Tommy Purwaka* and *Dr. Robert Pomeroy*

P.M.

Session 2: ICZM Analytical Tools and Research Experiences
Chairperson: *Dr. Edgardo D. Gomez*
Rapporteur: *Mr. James N. Paw*
GIS and Remote Sensing Technology. *Mr. James N. Paw* and *Ms. Maylene Loo*

Economic Valuation of Coastal Resources. *Dr. Robert S. Pomeroy*
Application of Rapid Appraisal Techniques for Assessment of the Coastal Zone in ASEAN. *Mr. Michael Pido* and *Dr. Chua Thia-Eng*
Community-Based Management: Applicability in ASEAN. *Prof. Elmer E. Ferrer*
Discussion
Discussants: *Dr. Kam Suan Pheng, Dr. Sitiporn Kajornatiyudh* and *Dr. Wong Poh Poh.*

Wednesday, April 29
Riverview Inn, Bandar Seri Begawan
A.M.

Session 2: ICZM Analytical Tools and Research Experiences (continued)
Chairperson: *Awang Haji Samat bin Haji Abas*
Rapporteur: *Mr. Michael Pido*
Capture Fisheries Management in Brunei Darussalam. *Awang Haji Halidi bin Mohd. Salleh* and *Mr. Geronimo T. Silvestre*
Coastal Tourism Management in ASEAN. *Dr. Wong Poh Poh*
Coral Reef Management in ASEAN. *Dr. Edgardo D. Gomez* and *Dr. Chou Loke Ming*
Mangrove Management Planning in ASEAN. *Dr. Prescillano M. Zamora*
Coastal Water Quality Management in Thailand. *Dr. Sittiporn Kajornatiyudh*
Integrated Coastal Resources Management in the Context of Brunei Darussalam. *Pg. Sharifuddin bin Pg. Haji Yusof* and *Mr. Geronimo T. Silvestre*
Discussion
Discussants: *Dr. M.W.R.N De Silva, Dr. Kasijan Romimohtarto* and *Dr. Ruangrai Tokrisna*

P.M.

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Chairperson: *Dr. Aprilani Soegiarto*
Rapporteur: *Dr. Richard Tobin*
Summary of In-Country ICZM Plan: Brunei Darussalam. *Pg. Sharifuddin bin Pg. Haji Yusof*
Summary of In-Country ICZM Plan: Indonesia. *Mr. Sukotjo Adisukresno*
Summary of In-Country ICZM Plan: Philippines. *Mr. Leonardo Quitos*
Summary of In-Country ICZM Plan: Singapore. *Dr. Chou Loke Ming*
Summary of In-Country ICZM Plan: Thailand. *Mr. Chalermsak Wanichsombat*

Discussion
Discussants: *Mr. Suharyadi Salim, Mr. Patrick Tan Hock Chuan, Ms. Maylene Loo* and *Ms. Orapin Wongchompit*
Thursday, April 30
Riverview Inn, Bandar Seri Begawan
A.M.

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Chairperson: *Dr. Richard Tobin*
Rapporteur: *Mr. Cesar Z. Luna*
Lessons Learned in ICZM Planning in ASEAN. *Dr. Chua Thia-Eng, Mr. Geronimo T. Silvestre* and *Mr. James N. Paw*
Global Integrated Coastal Zone Management Efforts and Experience. *Dr. Peter R. Burbridge*
The ASEAN Perspective: Lessons Learned from the ASEAN/US Coastal Resources Management Project. *Dr. Aprilani Soegiarto*
Discussion
Discussants: *Dr. Rogelio O. Juliano, Mr. Patrick Tan Hock Chuan* and *Mr. Chalermsak Wanichsombat*

P.M.

Session 4: General Discussion
Chairperson: *Dr. Chua Thia-Eng*
Rapporteur: *Dr. Robert S. Pomeroy*
General Discussion
Workshop Summary: *Dr. Peter R. Burbridge*
Closing Remarks: *Dr. Rafael D. Guerrero III*

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