

Improving the State of Coastal Areas in the Asia-Pacific Region

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Stresses impacting the coastal zone in the Asia-Pacific region are briefly reviewed under the headings of sustainable coastal activities, coastal ecosystem management, community/resource interactions, coastal resource economics and sustainability, coastal area planning, and integrated coastal policies. Recent contributions on mitigation of these stresses are introduced, with emphasis on the Coastal Zone Asia-Pacific Conference, held in Bangkok, May 2002, where various innovative approaches to research, education, information sharing, and coastal policies aiming at improving the state of the coastal areas were presented. These include the roles of community in integrated coastal management; tools and planning for management of coastal areas; education program and capacity building; and the establishments of national and regional frameworks for integrated coastal management. As appropriate information and its transfer are critical to these processes, an analysis is presented of the content of the database on coastal projects in the region, highlighting areas of research interests, funding sources, and achievements. Another database on coastal ecosystems, currently under development, is presented as an example of the type of resource that can be expected to help advance our knowledge and ability to improve the management of coastal areas. Overall, these tools should allow us, given the political will, to improve the state of coastal areas.

Keywords Asia-Pacific, database, education, integrated coastal management, national and regional framework, role of community, tools and planning

Received 26 July 2003; accepted 6 August 2003.

This contribution draws from the many papers presented at the CZAP Conference. We thank the presenters and those institutions that supported their participation and/or provided funds for the conference, as mentioned in the preface of this theme issue. In particular, Ratana Chuenpagdee wishes to thank the Virginia Institute of Marine Science and the Coastal Development Centre for their support of the conference. Daniel Pauly thanks the Pew Charitable Trust for funding the Sea Around Us Project and the National Science and Engineering Council of Canada for funding his other research.

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Introduction

Throughout Asia and the Pacific, the natural resources of coastal areas are strongly exploited, often to sustain local people's livelihood. Coastal development in the region has generally led to overexploitation of nearshore fisheries resources; coastal pollution from urban settlement, tourism and industrial development; and rapid decline of mangrove forests and degradation of other coastal ecosystems, such as seagrass beds and coral reefs. Given similar characteristics, in the Asia-Pacific region, of coastal ecosystems and patterns of resource exploitation, of dependence on the resources, and of common interests in ensuring the well being of coastal communities, information on approaches for addressing coastal development issues should be shared within the region. A Coastal Zone Asia-Pacific (CZAP) Conference was therefore held in Bangkok, Thailand, in May 2002, to facilitate exchanges and interactions among scientists, coastal practitioners, and policy makers from the Asia-Pacific region. The overall goal of this event was to improve the state of the coastal areas through wise uses of coastal resources and to explore innovative approaches in research, education, information sharing, and coastal policies to deal with both existing and emerging problems in coastal areas. This initiative corresponded to the need for adaptive approaches to coastal management, the development of place-based, participatory programs, and the learning and sharing of experiences identified by Olsen and Christie (2000) as priorities for integrated coastal management (ICM) in the next decade.

The CZAP 2002 conference addressed six themes related to coastal issues in the Asia-Pacific region: (i) sustainable coastal activities; (ii) coastal ecosystem management; (iii) community/resource interactions; (iv) coastal resource economics and sustainability; (v) coastal area planning; and (v) integrated coastal policies. The paragraphs below provide some background and brief summaries of these issues. We then present a description of a coastal project database developed as part of the conference preparation, and document recent trends among coastal initiatives in the region. Next, we highlight state-of-the-art and recent approaches presented at the conference for improving the state of coastal areas. These cover an enhanced role for community involvement in coastal management; planning and economic tools; educational programs and capacity building; national and regional frameworks for integrated coastal management; and information sharing mechanisms. We conclude with a description of a comprehensive coastal resource database, a subset of a global ocean database, assembled by the Sea Around Us Project (SAUP), University of British Columbia, Canada, as an example of an innovative tool for integrated coastal ecosystem management.

This article, thus, is not meant to add to the litany of contributions on why and how coastal ecosystems continue to be degraded. Rather, we emphasize positive approaches, however tentative, with which this trend can be reversed or at least some of the damages mitigated. We draw therein on materials presented at the CZAP Conference, the contributions in this theme issue, and our own experiences working on coastal issues on three continents.

Coastal Issues and Challenges in the Asia-Pacific Region

The major threats to coastal areas, and to the oceans worldwide, are coastal and marine pollution, overexploitation of coastal and marine resources, and coastal habitat loss (UNEP, 2002). While these threats are widespread in the Asia-Pacific region, the coastal issues dominating policy discussion are competing uses of fisheries resources and rapid and unplanned development of coastal areas, including those for aquaculture and tourism. Further, appropriate valuation of coastal resources and ecosystems using standard and

innovative economic tools is needed to assess their monetary and nonmonetary values. Although the Asia-Pacific region leads others in terms of comanagement and community-based management, there is a further need to identify effective mechanisms to involve communities in sustainable coastal resource management. Finally, the remaining challenge in coastal management is the difficulty of developing and implementing integrated coastal policies.

Many activities take place in the coastal areas, and they often interact in ways that are incompatible. Coastal fisheries, coastal aquaculture, and tourism are among several activities that can either coexist harmoniously or be in conflict, depending on how they are managed. Fishers in many areas are now able to use their fishing boats for tourism during the tourist season, and some of these fishers also farm fish. A Philippines case study on interactions between fisheries and tourism suggests, however, that tension can arise from the allocation of economic benefits resulting from the use by tourist operators of marine protected areas (MPAs) that fishers, not involved in the establishment of the MPA, cannot access (Oracion, Miller, & Christie, 2002). Within coastal fisheries, there are internal conflicts between fishers using different gears. A classic example is that between users of small-scale gear and trawlers in Southeast Asia, which have been well documented (Pauly, 1997). In Thailand and Indonesia, these conflicts led not only to loss of gear, but also to loss of life. Establishment of MPAs with community participation is considered an important tool to address conflicts in the uses of coastal areas (Elliott et al., 2001). Even in the Philippines, where MPAs are “comanaged” by community and local government (White, Salamunca, & Courtney, 2002), application of economic incentives and user fees, information sharing, and integrated coastal management are needed to improve their performance (White & Rosales, 2002).

Coastal aquaculture in many Asian-Pacific countries, in particular, farming of tiger prawn (*Penaeus monodon*) in Southeast Asia, has gone through a rapid development phase, from an extensive culture system, with low technology, requiring large farming areas, to an intensive culture system where production rates are greater, with high stocking density and feeding intensity. In the process, large areas of mangrove forests were converted into shrimp farms, resulting, for example, in the loss of 60 to 80 percent of mangrove cover in Thailand and the Philippines (Hidayati, 2000). As the number of farms increased, water pollution from farm effluents and diseases became a serious problem that eventually led to the catastrophic collapse of many shrimp farms, as witnessed in the Upper Gulf of Thailand (Dierberg & Kiattisimkul, 1996). In addition to environmental issues, the shrimp farming industry prompted passionate debates about social issues, including job losses for less-skilled coastal dwellers and concerns about food security resulting from privileging exports over domestic consumption (Dhamaraj, 2002). In Thailand, the most recent development of shrimp farming technology consists of a so-called bio-secure system involving closed recirculating water systems with reduced or zero water exchange, which allows re-siting of shrimp farms away from coastal areas, but without massive salinization of the land. These practices would help resolve the disease problems (Menasveta, 2002). However, the high capital investment and energy consumption raise doubts as to the long-term sustainability, particularly in view of the fall in oil supply predicted for future decades (Heinberg, 2003).

Rapid growth and development of coastal areas is another major concern in the Asia-Pacific region, particularly due to urban and industrial pollution. Ten of the world's megacities, i.e., cities with more than 10 million inhabitants, occur in the region, and, except for Delhi and Beijing, all are coastal. Many of these megacities lack the appropriate infrastructure and services, such as water supplies, sewage, health care, and education, needed to sustain their high-density populations (UNEP, 2002). The comparative analysis of Hanoi and Jakarta by King and Adeel (2002) suggests that improved

monitoring of pollution and better research on its impacts on coastal habitats are key to reducing the ecosystem impact of coastal megacities.

It is widely recognized that a balance is needed between meeting human needs and maintaining healthy ecosystems. Economic valuation often plays an important role in the decision-making process to achieve such balance. Standard economic tools, such as benefit–cost analysis, travel cost method, and contingent valuation, have been widely applied for valuation of coastal resources. For example, Seenprachawong (2002) applied the contingent valuation method to assess economic benefits of coral reefs in Thailand and suggested a user fee of U.S.\$1 to visit the park he studied, in addition to paying for other services. There is a need, however, to explore other tools, such as the nonmonetary valuation “damage schedule” (Chuenpagdee, Knetsch, & Brown, 2001) and generational cost–benefit analysis (Sumaila, 2001), applicable to the complexity of coastal resources and ecosystems and that allow for their sustainable use in the long term.

Community participation in natural resource management has been widely acknowledged as an important element promoting sustainability and resource conservation. Yet, further work is needed, notably on identifying and implementing effective mechanisms for involvement of local communities, particularly of stakeholders from other sectors, usually not included in the process. Hadley (2002) showed that involving communities in the management and planning of coastal tourism, and working in partnership with nongovernment and government organizations, can result in improving the well being of these communities. Further, cross-verification of local knowledge with scientific knowledge is useful in many coastal resource management and planning contexts. As suggested by Ruddle (2002), areas of cross-verification and joint learning include fisheries resource conservation through closed seasons or areas, resource mapping, environmental impact assessments, and rights-based management.

Finally, the key challenge for ICM is the lack of integrated coastal policies and effective implementation, due largely to the difficulty of coordinating among several government agencies responsible for managing coastal activities. In addition to distribution of authority, responsibility, and power required for new forms of management (Christie & White, 1997; Olsen & Christie, 2000), consistency and transparency are critical. New governance structures have been recently implemented in the region to foster sustainable ICM practices, for example, in Bangladesh and the Philippines. The Char Development and Settlement project in Bangladesh involves various levels of comanagement at the community and local levels, as well as at the regional and national levels (Wilde & Islam, 2002). Similarly, in the Philippines, the Integrated Population and Coastal Resource Management Initiative (I-POPCORM) was established as a cross-sectoral program for coastal resource management and population health, through partnership between local and regional environmental organizations; national, provincial and local governments; people’s organizations; entrepreneurs; and research institutes (Castro, Gorospe, & D’Agnes, 2002).

Recent Trends in Coastal Projects in the Asia-Pacific Region

Coastal zone management has received priority at many international meetings, particularly at the 1992 United Nations Conference on the Environment and Development (UNCED) in Rio de Janeiro and its follow-up, the 2002 “Rio+10” meeting in Johannesburg. As shown by Sorensen (1997), the 1992 meeting resulted in a drastic increase in the number of countries initiating coastal management projects and in the number of ICM-related activities. According to “Baseline 2000,” there were nearly 700 ICM initiatives at the international, national, and subnational levels at the beginning of 2002 (Sorensen, 2002), and funding for these programs was very high. For example, about \$1.3 billion was spent for coastal management in Latin America during 1992–2000, while the Asian

Development Bank invested \$1.2 billion for marine resource projects in Asia-Pacific. Clearly, a critical assessment of the success and effectiveness of ICM programs is needed using various ecological, social, and economic indicators to measure against their objectives (see contributions in Belfiore, 2003).

Similar to Baseline 2000, a database of coastal projects and research was created with a focus on the Asia-Pacific region (see www.vims.edu/czap). Colleagues interested in initiating projects and/or conducting research in the region can use it to find out what has already been done, and duplication of work can thus be avoided. For example, the preliminary analysis of this database, presented below, identifies the coastal issues that have been frequently addressed in the region and suggests others for future emphasis.

The database contains the following information for each project: name, location (country and area), coastal issues addressed, type of projects or activities, objectives, approaches and methodology employed, summary of findings, and lessons learned, outputs, start and end dates, number of countries involved, implementing agency, budget, source of funding, and contact person. Because information in the database was compiled from existing reports, literature, and web sites and from questionnaires completed by project staff, only major projects, often funded by large organizations, are well covered in the database, while small projects are underrepresented (this latter issue is addressed below).

As of this writing (June 2003), the database contains 289 projects conducted from 1992 to 2002. About 60% of the projects were conducted in Southeast and South Asia, with the rest in the South Pacific, Northeast Asia, and elsewhere. Project cost covered a wide range from less than U.S.\$10,000 to over U.S.\$100 million, with median cost ranging from U.S.\$1 million to U.S.\$10 million. About 75% of funding came from intergovernmental banks, in particular the World Bank and the Asian Development Bank, and through the bilateral aid agencies of Canada, various European countries, and the United States. An example is the large U.S.-funded project, CRMP, in the Philippines, established in 1996 with a large budget (\$18 million), and which interacts with 110 coastal local governments. International environmental organizations, such as the World Wildlife Fund for Nature and the Nature Conservancy, were also important sources of funding. Most coastal projects covered management, planning, and research, with some devoted to providing technical assistance and community development. The two coastal issues addressed by the majority of the projects were resource management and biodiversity. Several other issues were also covered, including social empowerment; coastal, environment, and watershed management; protected areas; and urban and port development. Issues of coastal protection, tourism, governance, and waste management were less well covered, though this may be the result of the biasing effect of the manner the database was assembled.

Coastal Initiatives for Improving the State of the Coastal Areas

Several initiatives on research, education, information sharing, and integrated policies to address current problems in the coastal areas were identified and prioritized by the participants of the CZAP Conference. Following is the summary of these prioritized initiatives.

Roles of the Community in Integrated Coastal Management

Overexploitation of coastal resources is often attributed to the lack of, or insufficient, community involvement in the management process and lack of integration between scientific and local knowledge, which leads to problems with implementation and enforcement (Kay & Alder, 1998). Thus, resource users and other coastal stakeholders

must be encouraged to involve themselves in the decision-making process and to contribute their knowledge to participatory research. Such research consists of three key elements: responding to the experiences and needs of the community, fostering collaboration between researchers and community in research activities, and promoting common knowledge and raising awareness among community members (Sohng, 1996). Based on these principles, best coastal practices should be reviewed and shared among coastal managers, to promote integration of natural and social scientific knowledge with local knowledge in the formulation and implementation of integrated coastal management plans.

An example of a community-based initiative in Bangladesh involved turning a village faced with a number of ecological problems (unproductive agricultural lands due to increased salinity from shrimp farming, lack of safe drinking water, insufficient access to hygienic sanitation facilities, and lack of environmental awareness) into an “ecological village,” enjoying a clean, healthy, and productive environment (Alam et al., 2002). An “eco-committee,” made up of community members, was formed to supervise projects meant to improve the environmental condition of the village and the health and safety of its members. Some successes were achieved, notably a high participation of women, diversification of farming systems, mangrove reforestation, generation of environmental funds, and development of increased skills for alternative employment.

As in fisheries, enforcement and compliance are major challenges for ICM. Crawford, in this issue, suggests that communities can play a critical role in ensuring that regulations are effectively enforced. Using three villages in North Sulawesi, Indonesia, he shows that communities can effectively encourage compliance with regulations and rules, provided that these were developed locally, that the areas to protect are small and near, and that violators are members of the community doing the enforcing.

Tools and Planning for Management of Coastal Areas

There is a need to address conflict uses of coastal resources, lack of suitably processed information on coastal ecosystems, lack of inappropriate land use planning for the coastal areas, and unsustainable aquaculture practices, some of which involve destruction of coastal vegetation. The measures to address these issues include, in terms of research, the use of an ecosystem-based approach for coastal management and the application of economic tools, remote sensing, and a geographical information system (GIS). Note that much of this research, traditionally done by academic scientists or in government laboratories, can also be done with communities in participatory mode and thus inject the local flavor and “groundtruthing” that is often missed in such research (Johannes, 1981; Chuenpagdee, Fraga, & Euan, in press).

Ecosystem-based fisheries management is now widely perceived as one of the possible ways to address overfishing around the world (NRC, 1999; Pauly et al., 2002; Pew Oceans Commission, 2003). One obvious ecosystem-based management tool is the creation of marine reserves, discussed in an extensive literature (see, e.g., Sumaila et al., 2000). Another component of ecosystem-based management is the explicit consideration of the feeding interactions between different functional groups in the ecosystem, as can be performed using the Ecopath with Ecosim (EwE) software (see www.ecopath.org). This is illustrated in the article by Bundy in this issue through an application to San Miguel Bay, Philippines, which demonstrates the importance of understanding species interactions and flow dynamics in fisheries assessment and management.

Ecosystem-based fisheries management also requires recognizing the close connection between coastal habitats, such as mangroves, coral reefs, and seagrass, and fisheries and other coastal activities. The Regional Marine Planning initiative in Australia is an example of an ecosystem-based management plan that integrates human uses, the

marine environment, and their relationships to coastal communities (Brooks, 2002). The *Marine Matters* atlas produced as part of this initiative provides an integration of social data for equal consideration alongside the biophysical, ecological, and economic perspectives.

One important aspect of ecosystems is the difficulty we face in assessing their “value.” Several valuations methods can be used to enhance our understanding of resource values for coastal resource management and to incorporate ecosystem value in the decision-making process (see, e.g., de Groot, 1992; Freeman, 1993; Knetsch, 1994; Rutherford, Knetsch, & Brown, 1998). Here we present the simple study conducted by Tongson and Dygico (published in this issue), using the “willingness-to-pay” approach. In this case, tourists, i.e., scuba divers, were asked how much they were willing to pay to visit the dive sites in the Tubbataha Reefs in the southern Philippines. The results were used to develop a two-tiered pricing scheme for foreign and local divers visiting the park. Another study, also in the Philippines, focuses on the costs of coastal area management, particularly when local communities are involved. Such costs are often neglected, causing unsuccessful implementation in many cases (Kuperan et al., 1998). Sumalde, in this issue, shows that the transaction costs associated with the implementation of a multi-level, multistakeholder program can be over one-third of total project costs. Questions resulting from this are whether such costs should be absorbed by the communities or shared between stakeholders, and whether such sharing would impede the management process or lead to improved performance.

This leads to the need for integration of ecological and economic considerations in a spatial context, as can be achieved using remote sensing and a GIS. In Cox’s Bazar, Bangladesh, these techniques were employed to identify suitable areas for mangrove forests, shrimp farms, and salt bed development (Hossain & Lin, 2002). Zoning based on GIS land-use mapping is appropriate for optimization of resource allocation and conflict resolution. Remote sensing technology can also be used to simply map coastal land use and monitor land use change (Doydee, 2002).

Education Programs and Capacity Building

Education to increase awareness about the importance of coastal resources is an important tool for reducing user conflicts, avoiding overexploitation of coastal resources and their ecosystem impacts, and promoting understanding about the interconnectivity of coastal habitats. In addition, education can help provide sustainability to coastal projects after donor support and funding end (Christie & Fauzi, 2002). Education initiatives, at the local and national levels, include education programs for children (from kindergarten to high school), uses of mass media campaigns on sustainable coastal resources, training programs on community-based coastal resource management, and training-the-trainers programs. Further, the use of the Internet to foster education and communication between coastal management practitioners and students can be successful but faces important economic and technological challenges (Kay & Christie, 2001).

A good amount of educational materials exist and can be used to foster ICM in Southeast Asia. Reviewing over 100 sets of such materials from the Philippines and Indonesia, Milne, Wright, and Christie (in this issue) find that these materials addressed a wide range of issues, including coral reefs and fisheries, resource conservation, and environmental education, and were available in many formats depending on target audience, for example, as books, web sites, TV programs, and board games. The evaluation of the effectiveness of these materials, based on a set of criteria such as interactive qualities, availability, geographical focus, etc., suggested that within countries, harmonization of education programs and material is important.

Because of the need to employ approaches from various disciplines to address coastal issues and the difficulty in understanding their different methods, a training framework, with a series of stages to guide trainees through an ICM process, is required. Le Tissier, in this issue, present such a training framework for ICM, developed in India and devoted to identifying and resolving conflicts between coastal stakeholders.

A dynamic regional education program that leads to viable integrated coastal management should be developed at the regional level. Some education initiatives are informal and aim to increase the awareness of coastal resource users and the community through integration of scientific information and local knowledge (Chuenpagdee et al., 2002). Others are formal programs for higher education, through regional networks of universities involved in ICM teaching and training (see, e.g., Smith, 2002; Reis et al., 2002). Further, a program to build large-scale public support for ICM, involving regional mass media campaigns, public communication programs, and distance learning is also deemed desirable (Chuenpagdee et al., 2002; Kullenberg, 2002; Mabudafhasi, 2002).

In addition to building capacity at the community level through education and awareness-raising programs, special education and training programs are needed to increase the capacity of coastal managers and practitioners, e.g., in form of training-the-trainers programs. For example, coastal managers need training in management skills and in the design and implementation of integrated coastal policies. Moreover, scientists are not always effective in communicating their work to the lay public, and thus often need training to work with journalists and media (Alcock, 2002). They and government officials also need to learn from local communities about the reality of their lives.

Establishing National and Regional Frameworks for Integrated Coastal Management

Policy issues impeding the success of coastal management in the Asia-Pacific region include lack of coordination; lack of appropriate institutional and legal frameworks (Eisma, 2002); short-term time frames; and low capacity for local governance and leadership. Important initiatives to address these issues within countries are development of legislative frameworks for community-based integrated coastal management; identification of supportive and nonsupportive factors for coordination in integrated coastal management between government agencies; building capacity for local governance and leadership; policy documents to promote intersectoral and administrative coordination; and organizing integrated coastal management seminars for high-level managers, executives, legislators, and key decision makers. It is important that these policies be internally coherent and mutually supportive. These policies, where possible, should also be harmonized between countries, thus enabling a coordinated approach to tackling transboundary issues, e.g., those pertaining to fisheries or pollution, and the joint seeking of external support. Examples of such initiatives for sectoral integration are being implemented for ICM in Europe (Humphrey & Burbridge, 2003; Capobianco et al., 2003).

In this issue, Wescott presents a three-tiered approach to coastal planning and management in Victoria, Australia, aiming to provide a balance between state government and local objectives, and to enhance community participation in decision making. The implementation of ICM in Victoria sets a useful example for others, as it points to the need for clearly stated objectives, clear identification of the lead agency, and comprehensive document planning and legislation at the state and national levels. Huda, in this issue, provides further examples of the need for various government agencies to maintain their independent status while cooperating with others in the joint execution of multisector ICM programs. His review of 15 government agencies in Bangladesh connected with coastal activities suggests that for ICM to work, a tight institutional,

organizational, legal, and financial framework is required, in addition to the institutional capacity to implement such program.

Data Collection and Information Sharing

Database development and information sharing is viewed as an important way to improve the state of the coastal areas. The databases considered useful for integrated coastal management are regional GIS reference databases, databases of coastal resources and ecosystems, and a database on coastal/marine invertebrates in Asia-Pacific region, as they complement the existing database of coastal/marine fishes (see below). Also, an information-sharing mechanism should be established to support institutionalization of integrated coastal policy in the region. This can be done through web sites (see, e.g., www.oneocean.org) or through collaboration with existing regional institutions, such as the Association of Southeast Asian Nations (ASEAN), and the Intergovernmental Oceanographic Commission's (IOC) Sub-Commission for Western Pacific. One example of such possible collaboration is the maintenance of the Coastal Project database described above and its expansion, notably to address the limited coverage of smaller projects.

A special mention must be made of FishBase (www.fishbase.org), the global database of fishes, whose coverage of coastal and marine fish biology and ecology in the Asia-Pacific region is very thorough. In addition, FishBase provides access to its information through both scientific and common names in various languages and non-Roman scripts, including Chinese and Thai. This user-friendliness was achieved thanks to input from numerous collaborators throughout the region (all explicitly acknowledged within the database), and readers are encouraged to join their number and to add their contribution to what has become the main source of information on coastal and marine fish biodiversity in the region.

Coastal Resource Database for Ecosystem Management

Here, an example of a coastal resource database, created by the Sea Around Us Project (SAUP; www.saup.fisheries.ubc.ca) and covering the world ocean but emphasizing coastal areas, is presented. The database basic units are cells of the half-degree latitude and longitude, i.e., with sides of 30 miles at the equator. The world ocean is covered by approximately 160,000 of these cells, but only about 20,000 of them are coastal, i.e., covering both land and water. These coastal cells, like all cells in the SAUP database, have biophysical attributes such as chlorophyll *a* concentration, mean water depth, mean water temperature, etc., derived from global remote sensing and/or oceanography databases. However, the coastal cells have additional attributes not shared with cells further offshore, such as percentage of water area covered by critical habitats (coral reefs, seagrasses, mangroves, and estuaries). These features of coastal cells are either adapted from databases assembled by other research groups or agencies (notably, the World Monitoring Data Center for, e.g., coral reefs data) or created by the SAUP (Alder, 2003).

These features of the coastal cells are used for three major purposes within the SAUP:

1. To enable, in the context of the rule-based algorithm for construction of the SAUP's global fisheries catch maps, for the catch of organisms with affinities to critical coastal habitats to be assigned correctly to coastal cells (via additional rules specific to the linkages between these organisms and their habitats).
2. To enable the production of national or regional resource or habitat evaluation through the identification of the coastal cells in the countries or regions in question, and thence the calculation of the sum of certain attributes, e.g., the catch of coral reef fishes, of these coastal cells.

3. To geo-reference the mariculture statistics of the Food and Agriculture Organization of the United Nations (FAO), so far available only in the form of national production tables.

Item 1 will require, in addition, that the FAO global catch statistics presently used to generate the SAUP catch map be complemented by national datasets with emphasis on the catch of small-scale fishers, usually not included in the FAO statistics, and which, for many coastal countries, will be the most important catch in coastal areas. This will also include estimating, for each country, the number and along-shore distribution of full-time small-scale fishers, usually a close correlate of small-scale fisheries catches. Item 2 requires close interactions between the SAUP and research groups maintaining databases providing ecological attributes to coastal cells, e.g., the group maintaining AlgaeBase (www.algaebase.org), wherein all the world kelp species are described. Item 3 will require identifying, for each maritime country, at least one published account from which the history, characteristic, and location of mariculture operations can be inferred. In combination, these three items will allow, when complemented with datasets on various forms of coastal pollution, inferences on water quality, harmful algal bloom, etc.—topics which the SAUP and its partners will be exploring in the future. From early 2004 on, the data on coastal fisheries catches and critical habitats mentioned above will be made available via the SAUP web site to interested coastal management practitioners and other users, by country and by large marine ecosystem, thus providing, via a single accessible source, a vast array of information usually scattered and available for only a few countries, mostly in incompatible format.

FishBase currently receives about 8 million “hits” per month, many from coastal developing countries, where it serves as a starting point for the development of locally enriched databases. The Philippines, for example, has recently modified FishBase to emphasize local fish collection and the status of coastal fish populations (see www.fishbase.org.ph/museums_new/searchphilippinefish.cfm). Similarly, the existing SAUP database, which documents marine fisheries around the world, is likely to attract an increasing number of users once it has been validated through interactions and modified to reflect the need of local groups. We can therefore assume that enriching the SAUP database with information relevant to coastal zone management, including habitat and environmental conditions, would help raise awareness at the regional and international levels of the importance of coastal ecosystems integration, and thus benefit coastal zone practitioners, if indirectly.

Conclusions

ICM is complicated: there are multitudes of stakeholders to accommodate, different levels of government to be considered simultaneously, the interaction between local and global effects to be addressed, all of these in the context of uncertainty, lack of information, lack of fund, and urgency. One element has to be the generalizing from lessons learned and disseminating the resulting generalization—hence this contribution, the theme issue, and the CZAP Conference from which it is derived.

Nowadays, not one week passes without newspapers reporting on an alarming coastal development or on the decline of coastal and marine resources throughout the world. Pessimism about the long-term prospect of our coasts and their resources may appear justified. The above review should have made clear, however, that the concepts and tools exist to turn these trends around, given the political will. Indeed, political will by national governments appears to be the key ingredient, lacking in countries where coastal degradation proceeds unchecked, and the crucial departure point in countries where successful ICM programs have been initiated. We hope that more governments will see the

need for their involvement and help unleash the power of the tools and concepts now available to improve the state of coastal areas.

References

- Alam, S. M. N., C. K. Lin, A. Begum, and M. M. Rahman. 2002. Coastal eco-village: An initiative in rebuilding coastal resources. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*, Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]
- Alcock, D. 2002. Communicating sciences to non-scientists. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*, Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]
- Alder, J. 2003. Putting the coast in the Sea Around Us Project. *Sea Around Us Project Newsletter*, January–February (15): 1–2. [Also available at www.saup.fisheries.ubc.ca]
- Belfiore, S., ed. 2003. The role of indicators in integrated coastal management. *Ocean and Coastal Management* 46:221–390.
- Brooks, K. 2002. Marine matters—mapping coastal communities in south-eastern Australia, and their links with marine activities. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*, Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]
- Capobianco, M., P. Caputi, P. de Girolamo, and D. Cuzzi. 2003. Integration of sectoral management activities in the coastal zone of the Regione Abruzzo, Italy: The case of RICAMA. *Coastal Management* 31:175–185.
- Castro, J., M. L. Gorospe, and L. D’Agnes. 2002. Integrating population and coastal resource management for food security: The Philippines’ Experience. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*, Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]
- Christie, P., and A. Fauzi. 2002. The integrated coastal management sustainability research project: Uncovering what affects process sustainability. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*, Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]
- Christie, P., and A. T. White. 1997. Trends in development of coastal area management in tropical countries: From central to community orientation. *Coastal Management* 25:155–181.
- Chuenpagdee, R., K. Juntarashote, P. Christie, and G. Giannico. 2002. Roles of education in sustaining ICM process. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*, Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]
- Chuenpagdee, R., J. Fraga, and J. Euan, Progressing toward co-management through participatory research. *Society and Natural Resources* [in press]
- Chuenpagdee, R., J. L. Knettsch, and T. C. Brown. 2001. Coastal management using public judgments, importance scales, and predetermined schedule. *Coastal Management* 29(4):253–270.
- De Groot, R. S. 1992. *Functions of nature: Evaluation of nature in environmental planning, management and decision-making*. New York: Wolters-Noordhoff.
- Dhamaraj, J. 2002. Violence of shrimp industry and coastal zone destruction. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*. Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]
- Dierberg, F. E., and W. Kiattisimkul. 1996. Issues, impacts, and implications of shrimp aquaculture in Thailand. *Environmental Management* 20(5):649–666.
- Doydee, P. 2002. Coastal land use change detection using remote sensing technique: Case study in Banten bay, West Java Island, Indonesia. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*, Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]
- Eisma, R. V. 2002. Legal issues affecting sustainability of integrated coastal management. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*. Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]
- Elliott, G., B. Mitchell, B. Wiltshire, I. A. Manan, and S. Wismer. 2001. Community participation in marine protected area management: Wakatobi National Park, Sulawesi, Indonesia. *Coastal Management* 29(4):295–316.
- Freeman, A. M. III. 1993. *The measurement of environmental and resource values, theory and methods*. Washington, DC: Resources for the Future.

- Hadley, N. P. 2002. Cooperative coastal tourism planning: Refining the process and outcome by involving communities, NGOs and private/public sector partnerships. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*, Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]
- Heinberg, R. 2003. *The party's over: Oil, war, and the fate of industrial societies*. New York: New Society Publishers.
- Hidayati, D. 2000. *Coastal management in ASEAN countries: The struggle to achieve sustainable coastal development*. Tokyo: The United Nations University.
- Hossain, M. S., and C. K. Lin. 2002. Land suitability analysis for integrated coastal zone management in Cox's Bazar, Bangladesh: A remote sensing and GIS approach. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*, Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]
- Humphrey, S., and P. Burbridge. 2003. Sectoral and territorial cooperation in the European demonstration programme on ICM. *Coastal Management* 31:155–162.
- Johannes, R. E. 1981. *Words of the lagoon: Fishing and marine lore in the Palau District of Micronesia*. Berkeley: University of California Press.
- Juntarashote, K. 1994. Possible development of community-based management in Thailand with the advent of fishing right system. In *Proceedings of the 7th IIFET Conference*, 18–21 July 1994, Taipei, Taiwan.
- Kay, R., and J. Alder. 1999. *Coastal planning and management*. New York: E & FN Spon.
- Kay, R., and P. Christie. 2001. An analysis of the impact of the Internet on coastal management. *Coastal Management* 29(3):157–182.
- King, C., and Z. Adeel. 2002. Comparative evaluation of the coastal impacts of major urban areas: Case study of Hanoi and Jakarta. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*, Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]
- Knetsch, J. L. 1994. Environmental valuation: Some problems with wrong questions and misleading answers. *Environmental Values* 3:351–368.
- Kullenberg, G. 2002. The virtual university approach. *Ocean and Coastal Management* 45:709–718.
- Kuperan, K., N. Mustapha, R. Abdullah, R. S. Pomeroy, E. Genio, and A. Salamanca. 1998. *Measuring transaction costs of fisheries co-management*. Presented at “Crossing Boundaries,” the Seventh Annual Conference of the International Association for the Study of Common Property, Vancouver, BC, Canada, June 10–14, 1998.
- Mabudahfhasi, R. 2002. The role of knowledge management and information sharing in capacity building in sustainable development—an example from South Africa. *Ocean and Coastal Management* 45:695–707.
- Menasveta, P. 2002. Development of shrimp culture systems for disease prevention and environmental sustainability. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*, Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]
- NRC. 1999. *Sustaining marine fisheries*. National Research Council. Washington, DC: National Academy Press.
- Olsen, S., and P. Christie. 2000. What are we learning from tropical coastal management experiences? *Coastal Management* 28(1):5–18.
- Oracion, E. G., M. L. Miller, and P. Christie. 2002. Understanding fishery-tourism interaction in marine sanctuaries: A critical issue in coastal management. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*, Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]
- Pauly, D. 1997. Small-scale fisheries in the tropics: Marginality, marginalization and some implication for fisheries management. In *Global trends: Fisheries Management*, ed. E. K. Pikitch, D. D. Huppert, and M. P. Sissenwine (eds.). American Fisheries Society Symposium 20, Bethesda, Maryland.
- Pauly, D., V. Christensen, S. Guénette, T. J. Pitcher, U. R. Sumaila, C. J. Walters, R. Watson, and D. Zeller. 2002. Toward sustainability in world fisheries. *Nature* 418:689–695.
- Pew Oceans Commission. 2003. *America's living oceans: Charting a course for sea change. Summary Report*. Arlington, VA: Pew Oceans Commission.
- Reis, E. G., C. R. Tagliani, M. L. Asmus, L. J. Calliari, and M. Bergesch. 2002. The Train-Sea-Coast Programme: New challenges for the development of human resources on coastal and ocean management in Brazil. *Ocean and Coastal Management* 45:667–676.
- Ruddle, K. 2002. System design principles: Including existing local resource management and knowledge within coastal area planning. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*, Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]

- Rutherford, M. B., J. L. Knetsch, and T.C. Brown. 1998. Assessing environmental losses: Judgments of importance and damage schedules. *Harvard Environmental Law Review* 22:51–101.
- Seenprachawong, U. 2002. An economic analysis of coral reef benefits from Phi Phi Islands, Thailand. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*, Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]
- Smith, H. D. 2002. The role of the social sciences in capacity building in ocean and coastal management. *Ocean and Coastal Management* 45:573–582.
- Sohng, S. 1996. Participatory research and community organizing. *Journal of Sociology and Social Welfare* 23(4):77–97.
- Sorensen, J. 1997. National and international efforts at integrated coastal management: Definition, achievements, lessons. *Coastal Management* 25: 3–41.
- Sorensen, J. 2002. *Baseline 2000 background report: The status of integrated coastal management as an international practice*. Second iteration, 26 August 2002, <http://www.uhi.umb.edu/b2k/baseline2000.pdf>
- Sumaila, U.R. 2001. Generational cost benefit analysis for evaluating marine ecosystem restoration. In *Fisheries impacts on North Atlantic Ecosystems: Evaluations and Policy Exploration*, ed. T. J. Pitcher, U. Sumaila, and D. Pauly. Fisheries Centre Research Reports 9(5): 94pp.
- Sumaila, U. R., S. Guénette, J. Alder, and R. Chuenpagdee. 2000. Addressing ecosystem effects of fishing using marine protected areas. *ICES Journal of Marine Science* 57(3):752–760.
- UNEP, 2002. *Global Environment Outlook 3: Past, present and future perspectives*. United Nations Environment Programme., London: Earthscan Publications.
- White, A., and R. Rosales. 2002. Incentives for marine protected area management in the Philippines: Rating, information and user fees. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*, Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]
- White, A. T., A. Salamanca, and C. A. Courtney 2002. Experience with marine protected area planning and management in the Philippines. *Coastal Management* 30:1–26
- Wilde, K., and M. R. Islam. 2002. The dimension of co-governance in coastal development: A case study from Bangladesh. In *Proceedings of the Coastal Zone Asia-Pacific Conference: Improving the State of the Coastal Areas*, Bangkok, Thailand, May 12–16, 2002, ed. R. Chuenpagdee. CD-ROM. [Also available at www.vims.edu/czap]

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