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PUSAT KAJIAN SUMBERDAYA PESISIR DAN LAUTAN

PENGANTAR REDAKSI

Puji dan Syukur dipanjatkan ke hadapan Tuhan Yang Maha Kuasa atas perkenan-Nya sehingga **Jurnal Pengelolaan Sumberdaya Pesisir dan Lautan Indonesia** dapat diterbitkan sesuai dengan rencana. Jurnal ini diharapkan dapat menjadi media informasi dan komunikasi antar disiplin ilmu yang mengulas masalah-masalah yang berkaitan dengan pengelolaan sumberdaya pesisir dan lautan, khususnya di Indonesia.

Penerbitan Jurnal Pengelolaan Sumberdaya Pesisir dan Lautan Indonesia merupakan hasil kerjasama antara Pusat Kajian Sumberdaya Pesisir dan Lautan Institut Pertanian Bogor (PKSPL – IPB) dengan *The Coastal Resources Center, University of Rhode Island U.S.A* (CRC-URI). Jurnal ini bertujuan untuk meningkatkan kesadaran dan kepedulian masyarakat luas akan pentingnya sumberdaya pesisir dan lautan, merangsang dialog diantara para praktisi dan pakar dalam pengelolaan sumberdaya pesisir dan lautan, dan membagi pengalaman dan pengetahuan diantara seluruh pemerhati masalah-masalah pengelolaan sumberdaya pesisir dan lautan.

Jurnal Pengelolaan Sumberdaya Pesisir dan Lautan Indonesia diterbitkan 2 (dua) kali dalam setahun dan diedarkan kepada para peminatnya yang berasal dari pejabat pemerintah dari seluruh tingkatan, kalangan akademik, para peneliti dan praktisi serta berbagai kalangan yang menjadi pemerhati masalah-masalah pengelolaan sumberdaya pesisir dan lautan.

Kami mengharapkan penerbitan perdana Jurnal ini dapat bermanfaat bagi semua kalangan yang terkait dengan pengelolaan sumberdaya pesisir dan lautan. Selamat membaca dan kontribusi anda kami tunggu.

Pemimpin Redaksi

Dr. Ir. Dietriech G. Bengen, DEA

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KATA PENGANTAR

Pertama-tama saya mengucapkan selamat atas penerbitan perdana dari Jurnal Pengelolaan Sumberdaya Pesisir dan Lautan Indonesia, yang merupakan kerjasama antara Pusat Kajian Sumberdaya Pesisir dan Lautan Institut Pertanian Bogor (PKSPL-IPB) dengan Coastal Resources Center University of Rhode Island USA (CRC-URI). Saya sangat berharap jurnal yang pertama kali diterbitkan di Indonesia tentang pengelolaaan sumberdaya pesisir dan lautan ini dapat menjadi forum informasi dan komunikasi yang berdaya guna dan berhasil guna, tidak hanya bagi kalangan akademis namun juga bagi pihak-pihak terkait lainnya di kalangan praktisi, birokrasi dan dunia usaha.

Keberadaan jurnal pengelolaan pesisir dan lautan ini juga sangat dibutuhkan tidak hanya secara lokal di Indonesia, namun juga bagi kalangan pemerhati dan praktisi pengelola sumberdaya pesisir dan lautan di luar negeri, termasuk dari kalangan investor swastanya. Hal ini sangat beralasan mengingat bahwa dengan mempertimbangkan potensi wilayah pesisir sebagai salah satu sumber keanekaragaman hayati pada ekosistem pantai dan pesisir di Indonesia, telah banyak upaya yang dilakukan dalam rangka menyusun suatu strategi dalam pengelolaan, konservasi dan rehabilitasi wilayah pesisir tersebut.

Lebih jauh lagi, dengan mempertimbangkan bahwa potensi wilayah pesisir yang dimiliki Indonesia merupakan yang terbesar di dunia maka pemanfaatan nilai ekonomisnya juga perlu dioptimalkan dan dikendalikan dengan memperhatikan upaya pelestariannya.

Pentingnya suatu jurnal informasi dan komunikasi tentang pengelolaan sumberdaya pesisir dan lautan yang berskala nasional, terutama dengan mempertimbangkan beberapa peranan pokok dari sumberdaya pesisir pada skala nasional sebagai berikut:

1. Peranan pentingnya dari ekosistem wilayah pesisir dalam upaya konservasi keanekaragaman hayati yang ada di kawasan pantai dan pesisir, terutama yang memiliki potensi pengembangan ekonomis berjangka panjang baik pada skala lokal masyarakat pesisir maupun dalam skala nasional.
2. Peranan penting wilayah pesisir di dalam mendukung upaya pelestarian lingkungan dan nilai-nilai ekologis, yang sekaligus diarahkan untuk dapat meningkatkan derajat kesejahteraan masyarakat pesisir serta mendukung upaya pembangunan yang berkelanjutan di tingkat nasional.
3. Peranan wilayah pesisir sebagai sumberdaya alam yang potensial pada skala nasional di dalam menunjang ekspor non migas yang bersumber dari industri pesisir dan maritim.
4. Peranan wilayah pesisir di dalam meningkatkan kesejahteraan masyarakat pesisir dan pantai, tanpa mengabaikan upaya pelestarian dan rehabilitasinya secara optimal dan berkelanjutan.

Dengan demikian, peranan dari ekosistem wilayah pesisir pada skala nasional maupun skala lokal adalah sangat potensial, baik ditinjau peranannya sebagai sumberdaya biologis maupun sumberdaya ekonomis.

Untuk itu, jurnal pengelolaan sumberdaya pesisir dan lautan ini diharapkan dapat memberikan informasi yang paling mutakhir tentang teori, pola dan praktek pengelolaan wilayah pesisir dan pantai yang berdaya guna dan berhasil guna, termasuk dalam rangka upaya pelestarian dan rehabilitasnya secara optimal dan berkelanjutan.

Selain peranan di atas, jurnal ini sekaligus diharapkan dapat pula menjadi suatu forum informasi dan komunikasi praktek pengelolaan sumberdaya pesisir dan lautan yang telah atau sedang dilaksanakan oleh pemerintah, baik yang dibiayai oleh anggaran pembangunan maupun bantuan luar negeri.

Seperti kita ketahui bersama, program pengelolaan wilayah pesisir dan pantai selama satu dasawarsa terakhir dan khususnya dalam Repelita VI ini telah memperoleh dukungan dari berbagai sumber pendanaan, termasuk yang berasal dari pinjaman/hibah luar negeri (PHLN) seperti melalui Proyek Marine Resources Evaluation and Planning (MREP) yang sejak tahun 1992 yang lalu dibiayai melalui pinjaman ADB. Selain itu, terdapat beberapa proyek lainnya yang tengah dipersiapkan saat ini yang diarahkan untuk meningkatkan dayaguna dan hasilguna pengelolaan ekosistem pesisir dan pantai, seperti yang akan dimulai pada tahun 1998 ini melalui Proyek COREMAP (Coral Reef Rehabilitation and Management Project) yang akan dilaksanakan dalam jangka panjang selama 15 tahun melalui pinjaman dari ADB, IBRD, dan hibah dari Pemerintah Australia.

Dengan memperhatikan keberadaan dari berbagai proyek yang telah dilaksanakan dengan investasi yang cukup mahal tersebut, maka jurnal ini menjadi sangat diperlukan dengan suatu forum informasi kepada kalangan terkait terhadap hasil dan rekomendasi yang dihasilkan dari pelaksanaan proyek-proyek tersebut. Berbagai temuan dan rekomendasi proyek yang dikemukakan melalui jurnal ini diharapkan selain dapat dijadikan bahan diskusi ilmiah di kalangan akademisi untuk pengembangan lebih lanjut, juga sebagai masukan bagi pengambilan keputusan dan kebijaksanaan dalam bidang pengelolaan sumberdaya pesisir dan lautan di Indonesia di masa yang akan datang.

Selain itu, di sisi perguruan tinggi seperti yang dilaksanakan IPB dengan PKSPL-nya, jurnal ini diharapkan dapat menjadi suatu forum komunikasi yang efektif di dalam tukar menukar informasi mutakhir mengenai teknologi dan pola pengelolaan sumberdaya pesisir dan pantai, baik diantara kalangan pengajar dan mahasiswa maupun antara pengajar dan mahasiswa. Terlebih lagi dengan mempertimbangkan keberadaan dari para mahasiswa S-2 dalam bidang Manajemen Sumberdaya Pesisir dan Lautan di IPB, yang baru saja dibentuk Program Pasca Sarjana sejak tahun terakhir ini.

Akhirnya, saya sangat mengharapkan penerbitan perdana dari jurnal pengelolaan sumberdaya pesisir dan lautan Indonesia ini dapat diteruskan dengan terbitan-terbitan selanjutnya secara berkala dan berkesinambungan. Hal ini saya kemukakan, mengingat kesinambungan dari suatu jurnal ilmiah dengan bidang kajian khusus seperti ini pada umumnya sangat tergantung dari materi dan substansi yang dikemukakan dalam setiap penerbitannya. Oleh sebab itu, perumusan materi dan substansi terbitan sangat perlu untuk direncanakan sejak dini untuk jangka waktu tertentu, dengan sekaligus memperhitungkan kemungkinan kesediaan calon kontributor/penyumbang tulisan bagi jurnal yang bersangkutan.

Sekali lagi, selamat atas penerbitan jurnal pengelolaan sumberdaya pesisir dan lautan Indonesia. Semoga jurnal ini dapat dimanfaatkan secara maksimal dalam rangka meningkatkan daya guna pemanfatan, pengendalian dan pelestarian sumberdaya pesisir dan lautan di Indonesia dalam masa yang akan datang.

Jakarta, 9 Maret 1998

Deputi Ketua Bappenas
Bidang Regional dan Daerah

Prof. Dr. Herman Haeruman Js.

DEPARTEMEN DALAM NEGERI
REPUBLIK INDONESIA

KATA PENGANTAR

Puji dan syukur kita persembahkan kehadirat Tuhan Yang Maha Kuasa karena atas berkat dan rahmatNya, "Jurnal Pengelolaan Sumberdaya Pesisir dan Lautan Indonesia", dapat diterbitkan untuk pertama kalinya. Jurnal ini memuat tulisan-tulisan ilmiah dari berbagai pakar dan praktisi yang berkiprah dalam bidang kelautan.

Sebagaimana diketahui Pengelolaan Sumberdaya Pesisir dan Lautan merupakan kebijaksanaan yang baru dimulai pada PJP II, Repelita VI. Sehingga gagasan, pemikiran, dan kajian dalam bentuk tulisan ilmiah sangat diperlukan untuk memberikan masukan-masukan yang berharga bagi para pelaku-pelaku pembangunan kelautan, peneliti, dan pengambil kebijaksanaan, khususnya pengelolaan wilayah pesisir terpadu.

Kita menyadari bahwa pembangunan baik di Indonesia maupun di negara-negara pantai lainnya akan lebih berkonsentrasi ke wilayah pesisir. Hal ini didorong oleh meningkatnya pembangunan kota-kota besar pantai, kawasan industri, pelabuhan, pengembangan wisata bahari, dan pembangunan perikanan yang menempati wilayah pesisir, mendorong urbanisasi yang semakin pesat ke wilayah pesisir. Hal ini meningkatkan kebutuhan akan sumberdaya pesisir dan lautan. Untuk itu diperlukan jurnal sebagai media informasi ilmiah dalam menyampaikan hasil kajian-kajian yang bermanfaat bagi pengelolaan sumberdaya pesisir dan lautan secara lestari.

Kepada para pembaca, kami harapkan masukan-masukan dan saran yang positif agar jurnal volume berikutnya dapat ditingkatkan secara lebih baik dan memenuhi harapan pembaca. Kepada para pengasuh dan pengelola jurnal saya menyampaikan penghargaan dan "selamat" atas penerbitan jurnal yang penting ini.

Jakarta, 9 Mei 1998

DIREKTUR JENDRAL PEMBANGUNAN DAERAH

H. FAISAL TAMIN

COASTAL RESOURCES CENTER

WELCOME FROM PROYEK PESISIR AND THE COASTAL RESOURCES CENTER, URI

On behalf of the Coastal Resources Center of the University of Rhode Island, it is our pleasure to offer our congratulations on publication of this first edition of the Indonesian Journal of Coastal and Marine Resources Management. The ever widening network of integrated coastal management (ICM) practitioners and researchers in Indonesia has identified the need to have a 'vehicle' for information exchange and a peer-reviewed journal that promotes professional advancement.

We hope this journal will help strengthen the Indonesian ICM profession by developing a body of skills, knowledge and experience which shall better equip Indonesia to meet national development aspirations whilst conserving the diverse coastal and marine resource base on which much of that development depends. We have witnessed a similar encouraging trend in the global ICM community as a result of our global Newsletter, Intercoast. By sharing the knowledge and experience of scientists, managers and other stakeholders this new journal will help to strengthen connections between ICM practitioners in Indonesia and further links between Indonesia and the global ICM network.

Obviously the success and sustainability of any new venture depends greatly on the commitment of those involved and its relevance to you, the users. While the commitment of everyone involved in the design and development of this journal is obvious in this edition (a big thank you to all the members of the editorial panel and authors), this new journal begins life entering relatively 'uncharted waters'. Interest in, and support for, ICM has reached an unprecedented level in Indonesia, however, we have yet to see the coalescing of interests, lessons and institutional capacity which is typical of maturing ICM programs elsewhere. In other words, there is much coastal management activity, but as yet, little integration.

We have high hopes that this journal, and other initiatives supported by Proyek Pesisir under the USAID-BAPPENAS Natural Resources Management Program, will contribute to improved integration of coastal management effort, particularly by helping to improve dialogue between research, management and non-governmental organisations. Ultimately, the success of the journal in this regard will, however, depend on you - the reader and contributor.

We encourage you to maximise the potential of this journal as a voice for improving the practice of coastal management in Indonesia and look forward to supporting you in realising our common agenda.

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TYPICAL GEOGRAPHIC INFORMATION SYSTEM (GIS) APPLICATIONS FOR COASTAL RESOURCES MANAGEMENT IN INDONESIA

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ABSTRACT

Coastal zone is a very complex, dynamic and delicate environment because of the influence of both terrestrial and marine ecosystems. As it is a delicate environment, sustainable utilization of its resources can only be achieved based on multiple, best and reasonable use with integrated approach. The approach requires a thorough understanding of the characteristics of the structures, functions, and dynamics of the coastal physical and human environment. Because an integrated management approach in coastal and marine resources is a must, the main planning objective is typically directed toward achieving the balance between three main goals: 1) exploiting natural prospect or endowment, 2) meeting the societal wish, and 3) accommodating the existing livelihood or conditions. This approach leads to a decision whether to enhance, to conserve, or to change the existing resource use strategy. As Indonesia is a very large maritime continent, planning and management of coastal and marine resources can best be conducted using this integrated approach supported by Geographic Information Systems (GIS) to characterize the resources, and to identify potential matches and or conflicts between the three goals. Understanding this typical GIS applications for coastal and marine resource management will be helpful in the identification of information and analysis needs for the GIS.

INTRODUCTION

Coastal zone is one of the most complex environment because of its transitional nature, mixing the land or the terrestrial and the marine ecosystems. The complexity of coastal environment can be seen, for example, from the river sedimentation regime which is influenced by many processes occurring deep in land at the upstream part of the river watershed. Similarly, erosional processes along the coast are influenced by many oceanographic characteristics which extends far offshore to the deep ocean.

Because of the influence of various forces in both terrestrial and marine ecosystems, coastal environment is always in a delicate balance. Any changes occurring in the land or at the sea, be that natural or human induced, may disturb the equilibrium of the system. It is therefore very important for resource managers working in coastal zones to always consider the impact of changes caused by resource utilization or exploitation to this delicate balance.

In its simplistic and traditional form, resource decision is a choice between exploitation and conservation. But more recently, the term sustainable use, that is the utilization of the resources as such that future generation has the opportunity to utilize the resources at the same level as the present, is more and more being pursued. Sustainable resource utilization, including that in the coastal zone, requires a comprehensive

understanding on how resources are structured, functions, and are changing such that reasonable and continued utilization can be achieved.

This paper presents examples of how information solution to answer some coastal resource management questions can be developed using sophisticated spatial information management tool known as the Geographic Information Systems (GIS). More attentions are given to the systematic approach to formulate information themes relevant to specific resource management (e.g., planning) needs as opposed to more technical discussion on the GIS as a tool. Readers wishing to learn more about the GIS tool should refer to the relevant literature.

RESOURCES UTILIZATION CYCLE AND ITS APPLICATION TO COASTAL ENVIRONMENT

The earth and its subsystems are a complex system with many physical components linked to one another (Orians, 1990). As a complex system, the earth is characterized by strong interactions between the parts, complex feedback loops, time and space lags, discontinuities, thresholds, and limits (Costanza *et al.*, 1993). Natural resource utilization is a process of subtraction and/or addition of materials to and from the system. This process causes changes to the components of the system by using some of the physical resources and/or introducing new resources to the system. Physical resources cannot be used sustainably because of their finite numbers. However, many physical processes have regenerative properties which make the resources renewable.

Degradation of resources occurs when a system's processing capacity is exceeded by resource use (Orians, 1990). Sustainable resource development, as defined by the World Commission on Environment and Development, is a development that meets the needs of present generation without compromising the ability of future generation to meet their own needs (Pezzey, 1992; Orians, 1990; Soemarwoto, 1991; Turner *et al.*, 1993).

Because natural resource utilization involves the use of biological resources as part of the earth's complex ecosystem, the concept of ecological sustainability must consider the availability of these resources. A general model for an ecological-economic system has been proposed by Holling (1992). In this model, a complex system is described as having four basic functions including: 1)exploitation, 2)conservation, 3)release, and 4)reorganization (Figure 1).

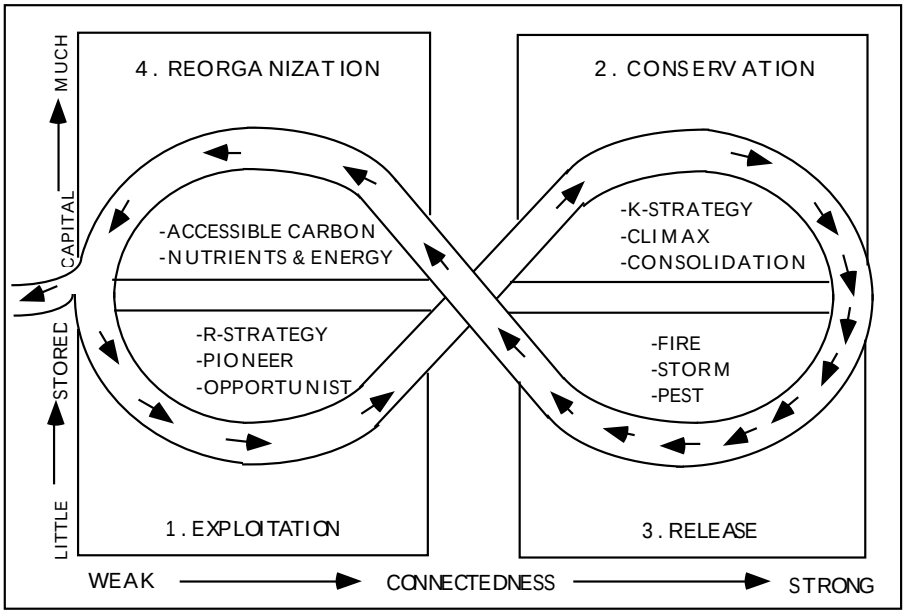

Figure 1. The four functions of a complex ecosystem (after Holling, 1992).

Based on this model, a system will follow a path where it evolves from an exploitation stage, where colonization occurs following a succession of a disturbed site or in a pioneer site, to a conservation stage where the system has reached a climax stage and needs consolidation. Following conservation, resources become abundant and the structure becomes mature such that releases of accumulated energy and nutrients are at a threshold of occurrence. Released nutrients and energy are then available for reorganization and for use in the next exploitation cycle (Holling, 1992). Holling's concept serves as a generalized ecological model where sustainability can be achieved by ensuring cyclic repeatability. Despite its generality, questions related to diversity, spatial organization, and resilience remain unanswered (Costanza *et al.*, 1993). Therefore, spatial representation of the ecosystem's structure and some measure of ecosystem's health needs to be added to this model.

In coastal resource management, the concept proposed by Hollings (1992) can be applied to achieve sustainable utilization. Although the application cannot simply divide the utilization stage into strict four stages, the underlying concept can be used to understand the cyclic mechanism of the resources under consideration. Once the cycle is understood, an exploitation strategy could be developed. In a fish resource utilization, for example, a sustainable fish exploitation can be planned based on the understanding of the fish resource space and time distributions. Time and space allocation can be determined based on the timing and location distribution where fish abundance occurs. Limit can be set such that regenerative process (consolidation stage) can be maintained at an optimum level.

CHARACTERIZATION OF COASTAL RESOURCES USING GIS

Ideally, any coastal resource utilization effort is planned considering the resource cycle as presented by the above Hollings' concept. However, as knowledge concerning resource characteristics is often incomplete *vis-a-vis* urgent and immediate resource utilization needs, only limited aspects directly relevant to the planning objective of the resource utilization are usually considered. In the development of coastal tourism, for example, the aspects considered in planning can be simplified to those directly relevant to tourism such as tourist attraction objects, tourist facilities, and transportation accessibility.

As indicated in the introduction of this paper, coastal environment is very complex, involves many processes across terrestrial and marine spaces, very dynamics and is always in delicate balance. Understanding the structure and the dynamics of coastal environment as a system is substantial in planning a sustainable coastal resource management (Dahuri, *et al*., 1996). There are three main aspects: structure, functions, and change or dynamics that are typically used to characterize a landscape ecosystem (Forman and Godron, 1986) or a larger geo-ecosystem (Hugget, 1995). The science of geography has the main purpose of characterizing the structure, the functions and the dynamics of the ecosystem under consideration by presenting the facts about the ecosystem in three different dimensions : spatial, temporal and thematic (Gunawan, 1997).

Geographic Information System (GIS) can traditionally be viewed both as a tool for spatial data management , and as a system of spatial information. As a tool, GIS has the capability of storing, retrieving, managing, analyzing and visualizing spatial information and its associated non-spatial attributes. As a system, on the other hand, GIS is a process of communicating spatial information (e.g., resource characteristics) among members of the society including scientist, resource managers and planners. Figure 2 visualize the schematic diagram of GIS as a tool and as an information system

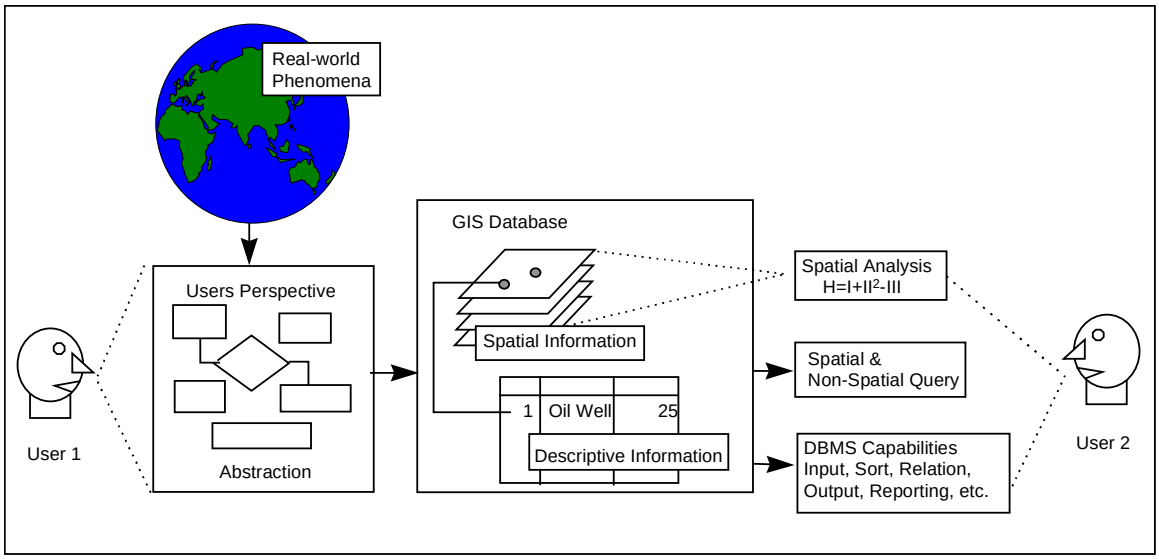

Figure 2. GIS as a tool and as an information system

In coastal resource management, GIS can be used to present basic spatial facts concerning the coastal physical and human environment in terms of its structures, functions and dynamics. For coastal physical environment, for example, the basic spatial facts include coastal topography/bathymetry, morphology, vegetation cover, sediment flow, erosion and deposition, climate, habitat boundary, and many other physical characteristics. For coastal human environment, the basic spatial facts include administrative boundary, population distribution, transportation and distribution network, and many other human/social characteristics. Table 1 lists some examples of GIS layers depicting structure, function and dynamics of the coastal environment.

Table 1. List of some GIS layers representing structure, function and dynamics of coastal environment.

COMPONENTS/ CHARACTERISTICS	LAYER	SUB-SYSTEM
Structure	Topography/Bathymetry	Physical
	Land cover	Physical
	Coral Reef coverage	Physical
	Population Distribution	Human
	Land use designation	Human
Function	Habitat	Physical
	Bird Sanctuary	Physical
	Settlement Location	Human
	Activity Distribution	Human
Dynamics	Sediment Transport	Physical
	Coastal Erosion	Physical
	Fish Migratory Pattern	Physical
	Journey to work	Human
	Income distribution	Human

In general, a well designed GIS for coastal resource management should be able to, at least, present and visualize the spatial structures of the resources, the spatial processes depicting various functions of the structures, and the spatial change depicting the dynamics of the coastal environment. More advanced coastal GIS would be able to model some conditions, responses, or changes based on a "what-if" scenario.

SPATIAL INFORMATION USAGE IN COASTAL RESOURCES MANAGEMENT

In addition to the natural complexity of the coastal areas as physical ecosystems, many social aspects related to population wealth disparity, different economic development interests, and environmental impacts caused by unplanned resource use are also typical social complexity that can be found in the coastal environment. Biological diversity, in view of fish and other biological resource prospects; physical connectivity,

in view of sea transportation and industrial location prospects; and aesthetic values, in view of tourism prospects are at least the three main factors that make coastal zone very attractive for development and settlement. Combination of all of the above factors consequently gives only one best solution to the sustainable utilization of coastal resources, that is the integrated management based on **reasonable, multiple** and **best use** policies (Kenchington, 1995; Dahuri, *et al*., 1996). The objective of a sound coastal zone resource management is, therefore, meeting the needs of members of the society, also known as the stakeholders, who are very dependent on the coastal environment at the same time maintaining the natural functioning of the coastal environment as a natural system.

In a simplistic form, coastal zone planning can be seen as a process of balancing three main objectives: 1) exploiting the **ideal prospects** or endowment; 2) meeting the **wish of the society** (that may vary from the local fisherman's to the international chain of resort hotels'); and 3) accommodating **existing livelihood** currently in place in the area under consideration. Translating these goals into a coastal spatial information system, consequently there are at least three major information themes. The natural prospects theme may consist of many information sub-themes varying from soil fertility map, fish distributions or migratory patterns, to coral reef and white sandy beach locations. The society-wish theme may consist of sub-themes varying from land use and zoning plan, fisherman traditional settlement and fishing route, to hotel and restaurant expansion plans. And lastly, the existing livelihood theme may consist of sub-themes varying from current land use and land cover to existing land ownership.

In a GIS implementation, the three main themes as listed above represent thematic layers of basic information necessary in the GIS for integrated coastal resource management application. As the spatial reality depicted by the thematic layers may suggest either a matching or a conflicting conditions between prospects, wishes and existing, the related GIS analyses will also be typically targeted toward assessing existing and potential matches or existing and potential conflicts between the three main themes.

Another aspect of coastal and marine resource planning is scenario development under "what-if" conditions. As coastal and marine environment consists of very dynamic and interlinked components, understanding the impact of changes or occurrence in one component to the other is very important. This typical GIS application usually requires the integration of the results of GIS thematic layers analysis to a certain model that predicts the outcome of the "what-if " conditions. In the implementation, a model-GIS integration is mainly used to compare and identify several scenarios that have the highest possibility of occurring. Figure 3 presents a schematic diagram visualizing the typical GIS usage in an integrated marine and coastal resource management.

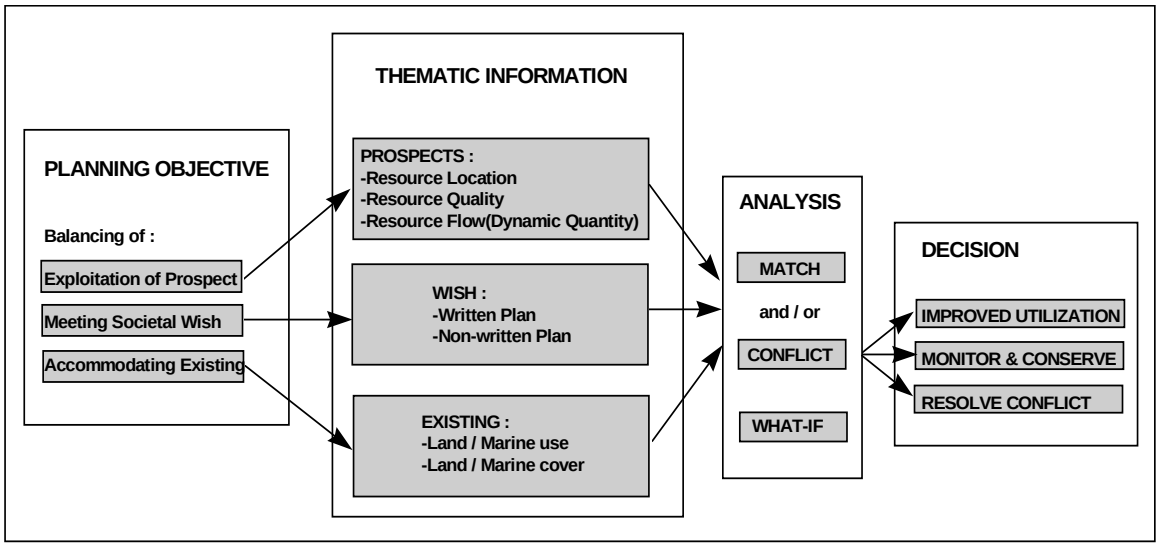

Figure 3. Typical GIS usage in integrated marine and coastal resource management

From an information system perspective, the development of the GIS includes standard database design process such as user identification, user needs assessment, system design, and implementation. In a coastal resource management, as integrated approach is the only solution, information depicting all stakeholders' perspectives should be known by any user. In other word, the targeted users for marine and coastal management GIS include everyone concerned with the coastal environment. GIS for tourism planning, for example, should also present all spatial facts related to fishery, agriculture, industry and other activities that may have an impact to, or be impacted by the anticipated tourism development.

APPLICATION IN THE INDONESIAN CONTEXT

Indonesia's coastal resources play an important role in the economy of the country. More than twenty two percent of the population live in coastal areas ranging from the highly urbanized and better income in northern coast of Java to the poorest fishing villages scattered throughout most of the other islands. Many development efforts have not seriously considered the importance of protecting marine and coastal resources. Culturally, the ocean is always considered as the backyard, and institutionally jurisdiction over marine areas remain within the national government. Only recently that efforts to decentralize the management of marine and coastal resources have been initiated. But, many questions concerning the level of management to be handed over and the delineation of the management boundaries have not been able to be resolved.

In the recent years a number of projects have been conducted as the initial step toward institutionalizing more sustainable marine and coastal resources. As the implementation of the past state guidelines, particularly in the marine sector, a basic marine and coastal information infrastructure has been developed under the national Marine Resource Evaluation and Planning (MREP) project. Under this project, national marine and coastal resource

databases have been developed using GIS technology. Empowerment of coastal communities in view of practicing sustainable utilization of coral reef resources has also been initiated through the Coral Reef Rehabilitation and Management Program (COREMAP). Other projects addressing more specific local, regional and sectoral issues have also been conducted at smaller extent.

As sustainable and integrated marine and coastal development is becoming a necessity, efforts to better institutionalize such a development are continued. A special national council to coordinate national maritime affairs has been established under Presidential Decree No. 71/1996. The continuation of the MREP project is being focused on providing information solution to priority marine and coastal spatial planning needs of the provinces involved in the project. As providing information solution is the main objective, a GIS application development approach should be utilized. Two examples of GIS application development beginning with Entity-Relationship database design approach and continued to database implementation and spatial analysis are presented in the following paragraphs. The presentation of these examples is intended to provide an overview of how GIS can be developed as an information solution to answer some coastal resource management questions, versus a data management toolbox approach that most data providing institutions would typically use. As works and utilization on these examples are still in progress, results presented are not at their final forms.

GIS for coastal and marine regional development planning : Manado-Bitung

A GIS application prototype for sustainable regional development planning has been developed for coastal and marine area of the northern coast of North Sulawesi between the cities of Manado and Bitung. As the translation of the natural prospect or endowment, the development objective, and the existing conditions of the area, two sets of GIS analysis schemes were developed. The first scheme represents a major requirement for maintaining the existence of the tourism prospects of the area. The requirement calls for the conservation/protection of the Bunaken marine national park as the core attraction site for the tourism industry in the area. Four main entities were identified namely : 1)basic morphological structure, 2) concerned conservation areas, 3) coastal processes, and 4) environmental concern, mainly river transported pollution (Figure 4).

In the implementation of the GIS database, these sub-entities were translated into GIS thematic layers. Basic morphological structure such as coastline, topography, bathymetry, hydrography, landuse are considered as base layers depicting the basic physical environmental structure. Boundary of large catchment of rivers flowing toward Manado bay was delineated to determine the pollution source areas. Non-point pollution concern for the protection of the conservation areas is identified by classifying land uses into their associated pollution impacts. Agricultural and urban land use are considered to be high concern areas for non-pollution source to the river system flowing toward Manado bay where the Bunaken marine park is located. Two hundred meter buffers around rivers in the catchment were then delineated to further identify areas with the highest concern of non-point pollution to the Bunaken marine park. Plate 1 shows GIS layer resulted from this simple analysis.

The second analysis scheme for Manado-Bitung GIS application represents the tourism development objective of the area to extent the length of stay of tourist by providing more tourist attraction in addition to the marine park only. This objective is translated into the identification of new tourism prospects in the area. Five entities were identified as suitable to represent factors significant to tourism development namely : 1) tourism attraction, 2) tourism facility, 3) accessibility, and 4) human resources. Each major entity is further divided into sub-entities as presented in Figure 5.

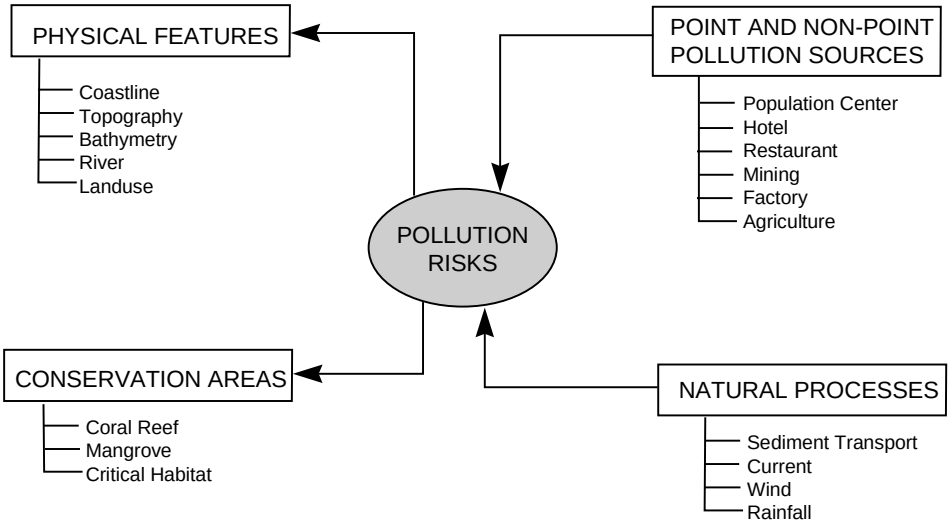

Figure 4. Entity diagram for marine park pollution prevention GIS application

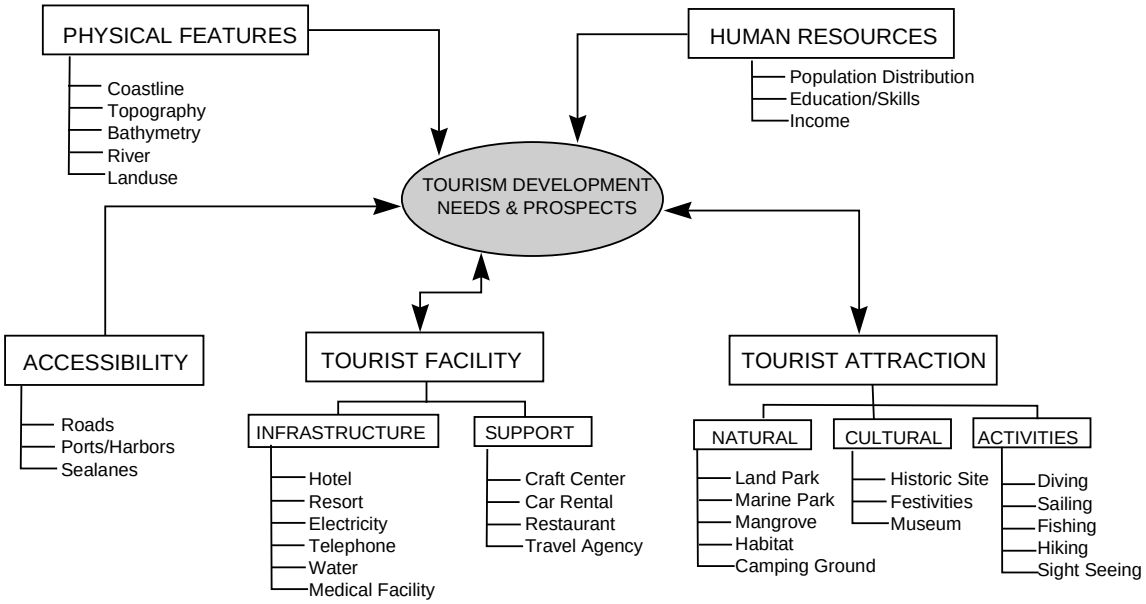

Figure 5. Entity diagram for tourism development prospects

In the implementation of the GIS database, these simple entities were also translated into GIS thematic layers. No spatial analysis was currently performed for this scheme as the data availability is very limited. A simple cartographic enhancement was conducted to highlight existing tourist attraction and some indications of accessibility (Plate 2). Further analysis can be performed using network and spatial interaction analyses if tourist movement (transportation) and stays information are available. GIS application as described in this first example is typical application that can be extended and applied in the management of coastal and marine resources in many parts of Indonesia where tourism is of significant development prospect.

GIS for oil spill contingency plnning application : East Kalimantan

A GIS application prototype for developing oil spill contingency plan has been constructed for a study area of the East Kalimantan Province off the coast of the Mahakam river delta. As a translation of the actual oill spill event, real world phenomena have been represented by three major entities namely : 1) coastal environmental characteristics, 2) oceanographic characteristics, and 3) oil spill scenarios. Each major entity is further divided into normalized/simpler sub-entities (figure 6).

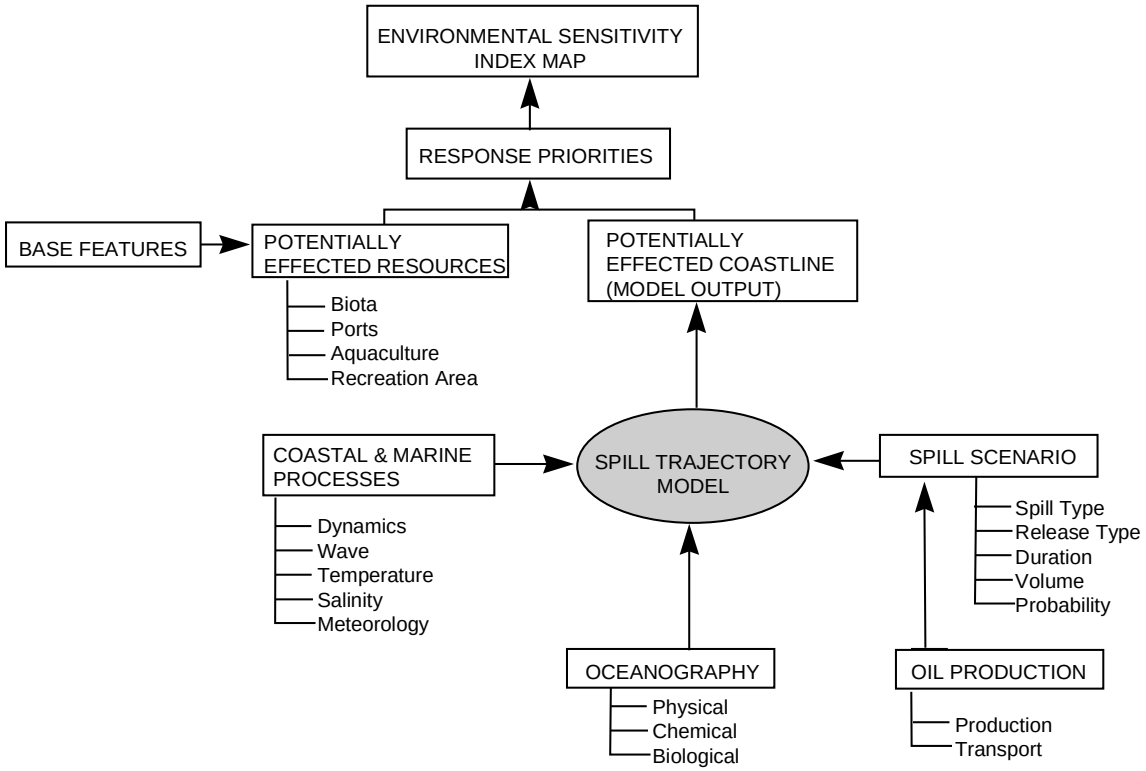

Figure 6. Entitiy diagram for oil spill GIS application.

In the implementation of the GIS database, these simple entities were first translated into GIS thematic layers. Coastal environmental characteristics were then determined as its sensitivity to environmental degradation. Attribute classification of various coastal features was conducted using look-up table to rank each feature from high to low sensitivity index. The first derivative product is a new thematic layer depicting the Environmental Sensitivity Index (ESI) of the coastal environment.

Oceanographic characteristics and oil spill scenarios were both combined in a spatial analysis to determine the potential impacts of various oil spill scenarios to the coastal environment. Spill scenarios ranging from offshore blowout to ship loading spills were assessed by running trajectory and spreading models. The models consider various oil spill characteristics such as oil amount and physical properties, and oceanographic characteristics such as wind and current direction and speed (Gunawan, *et al*., 1996). Plate 3 shows an example of GIS analysis results of the East Kalimantan oil spill contingency GIS development depicting both coastal environmental sensitivity index and oil spill trajectory and spreading. This GIS application example shows a type of GIS usage for the planning of coastal and marine resource environmental protection and conservation.

The two examples presented above demonstrate that although the general heading under which they are developed are the same, coastal resource management, the information content of each application may differ. In fact, for each planning analysis, different sets of thematic information are needed depending on the analysis objective. Therefore, one should not generalize how a GIS for coastal resource management should be formed, but rather how information themes should be customized to provide specific answer to specific resource management question. For a resource utilization application such as fish exploitation for example, the availability of information on resource dynamics (e.g., fish stock over time) is a necessity. This type of information is not usually readily available and needs special effort to acquire because different types of resource may have different dynamics.

RECENT CHALLENGES

As of the time when this paper is being prepared, a monetary crisis has hit the Southeast and East Asian regions including Indonesia. For the small but critical part at the end of Indonesia's first long-term development phase, development orientation has been diverted from the basic strength of Indonesia's endowment which is the natural resources, to non-resource based manufacturing and services industries. Although the argument over the higher importance of economic competitive advantage as compared to resource based comparative advantage has a strong basis in a more market oriented and global economy, the fact that no single advanced economy is separated from its resource basis should give Indonesian an important lesson.

The current economic crisis will not end only by any reform program. Only by creating new economic opportunities that recession could be overcome. In the period of recession, only resource based opportunities can be created in shorter term to relief the economic slow down. As a maritime continent country, Indonesia will have to rely more on its coastal and marine

resources more than to its land based resources. It is therefore very important to have a complete understanding on the coastal and marine resource structures, functions and dynamics that utilization of these resources can be conducted in a productive and sustainable manner. GIS as an information solution plays a very important role in providing venues for managing, analyzing, and communicating various information related to the opportunities and the constraints of Indonesia's coastal and marine resources development.

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Plate 1. Example of GIS for Non-point source pollution identification.

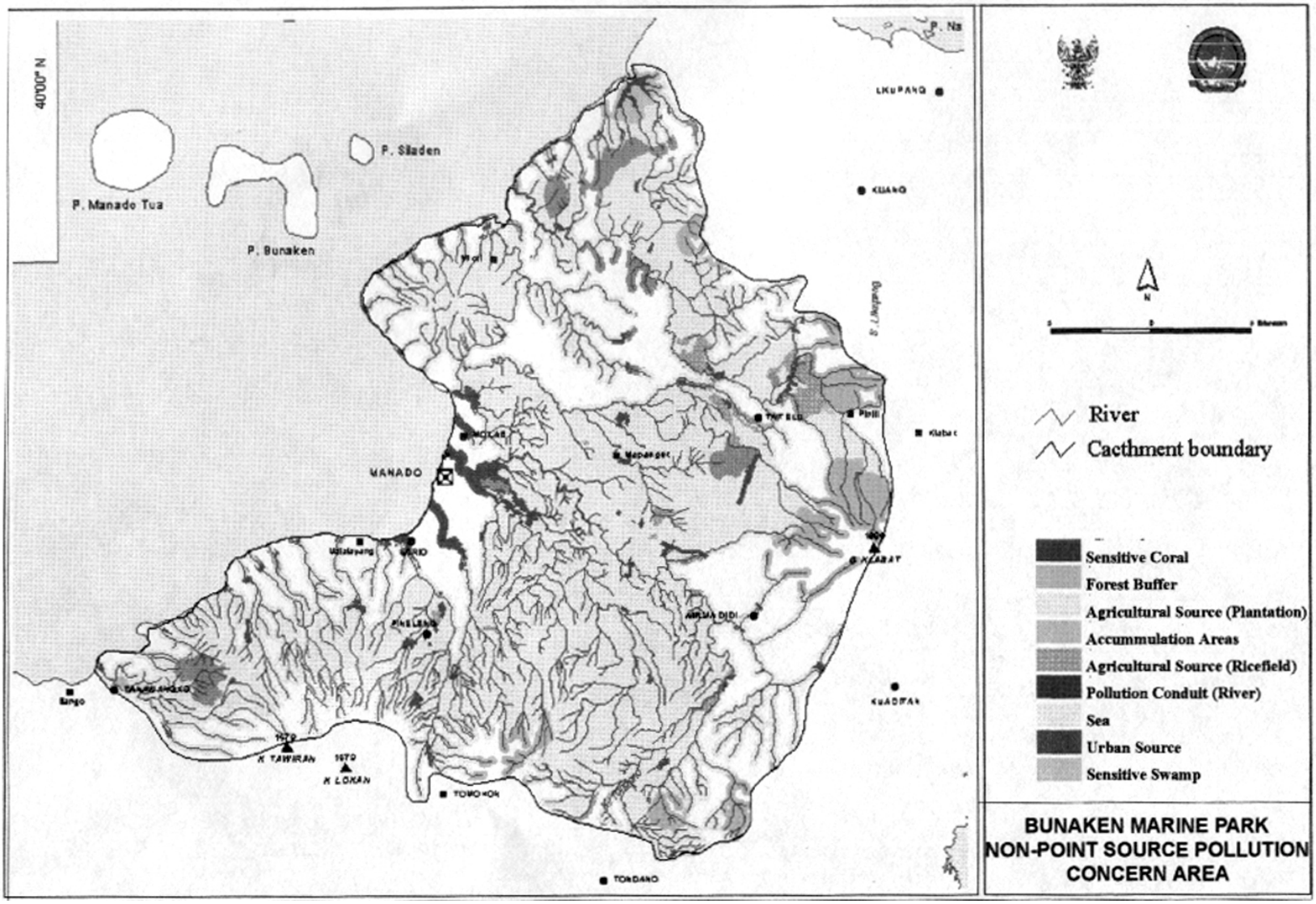
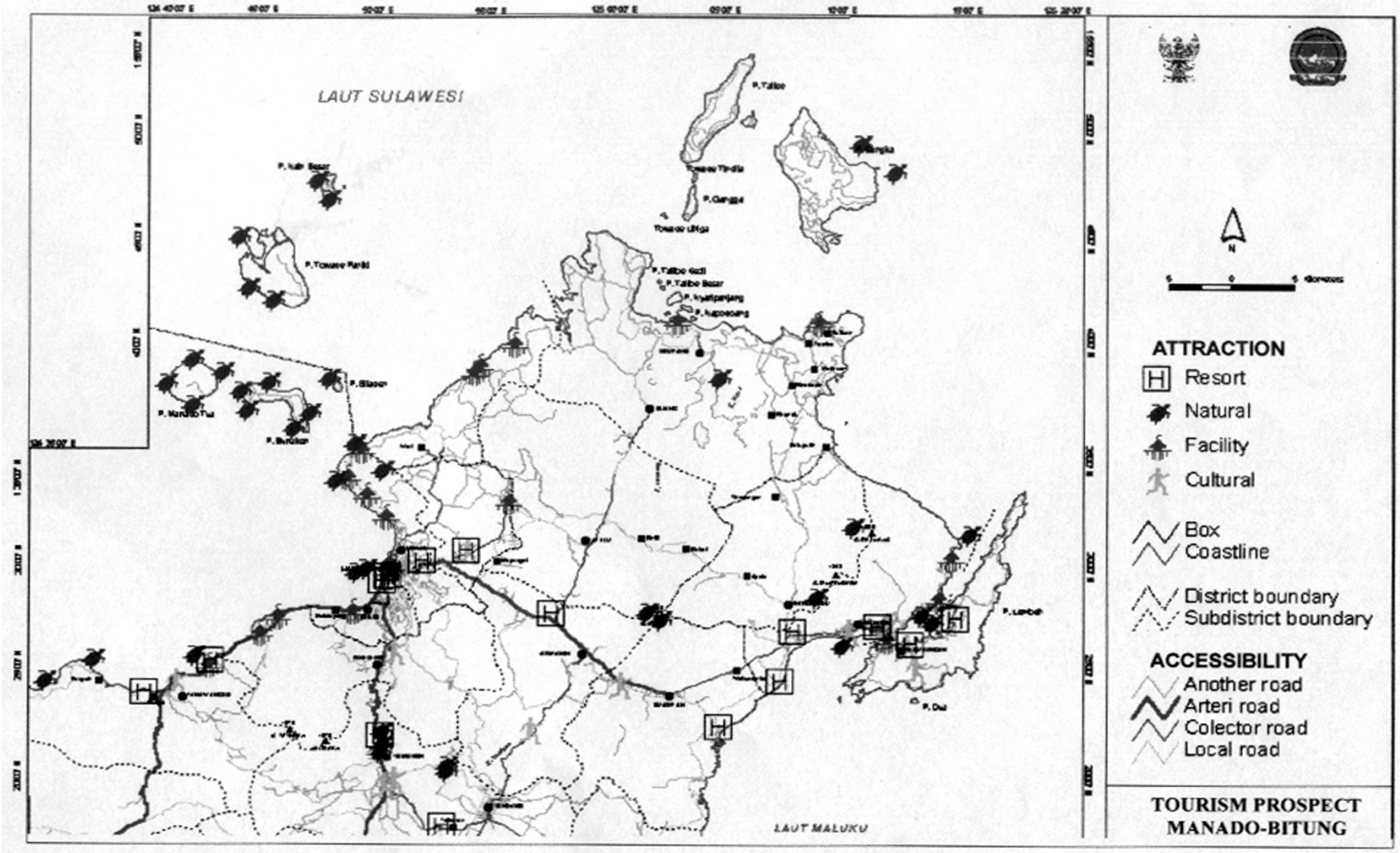
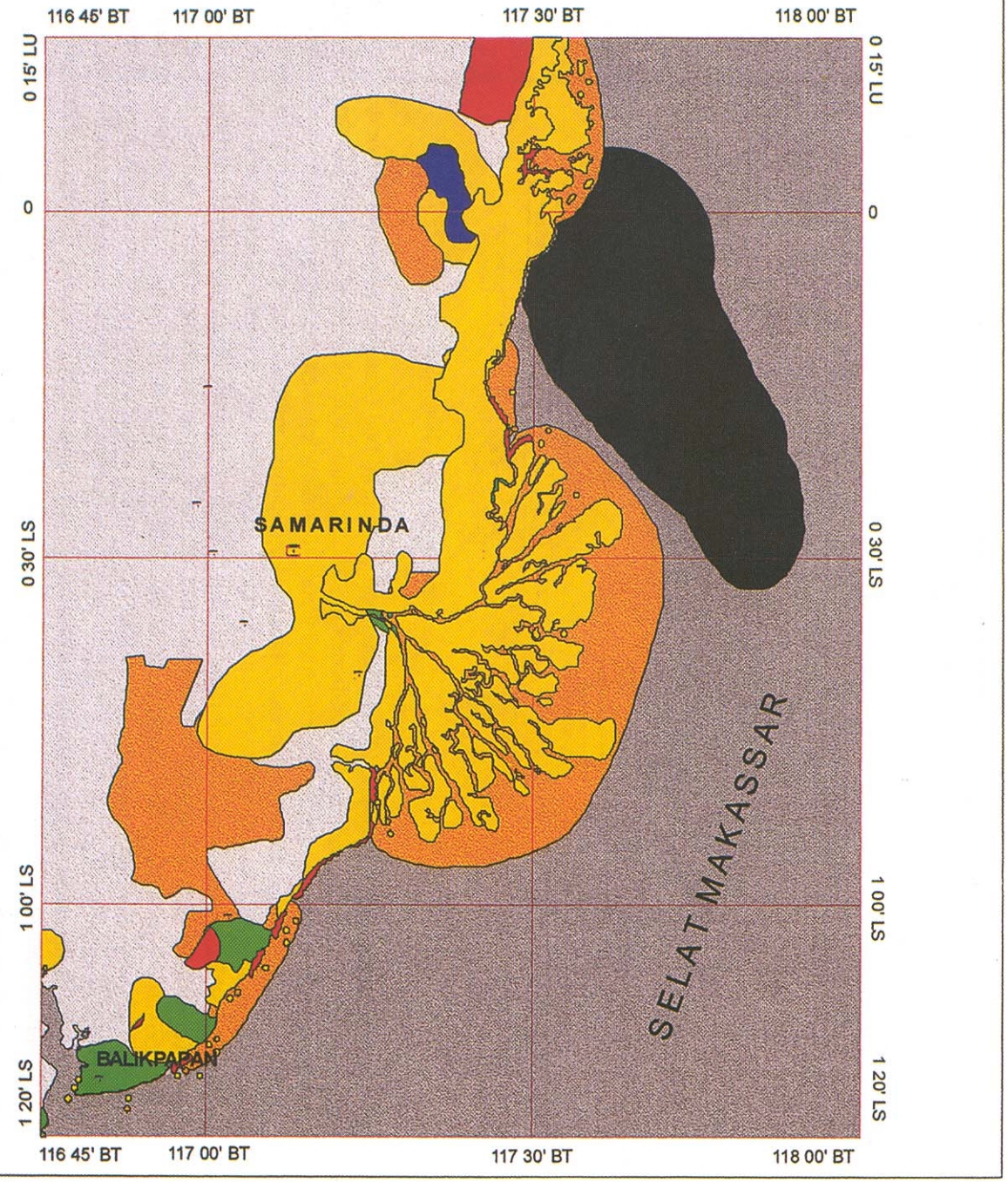


Plate 2. Example of GIS for tourism planning application.





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DIREKTORAT TEKNOLOGI INVENTARISASI
SUMBERDAYA ALAM
DEPUTI BIDANG PKA
BPP TEKNOLOGI
1997

PETA INDEKS KEPEKAAN LINGKUNGAN DAN SIMULASI PENYEBARAN TUMPAHAN MINYAK DI KALIMANTAN TIMUR

N
W E
S

Sekala 1 : 1.500.000

15 0 15 30 45 Km

Keterangan:

- Sensitivitas/Kepekaan 5
- Sensitivitas/Kepekaan 4
- Sensitivitas/Kepekaan 3
- Sensitivitas/Kepekaan 2
- Sensitivitas/Kepekaan 1

- Ibukota Kabupaten
- Ibukota Kecamatan
- Ibukota Propinsi
- Penyebaran tumpahan minyak dengan asumsi volume = 150.000 barrel selama 7 hari
- Laut
- Pulau

THE APPLICATION OF CARRYING CAPACITY CONCEPT FOR SUSTAINABLE COASTAL RESOURCES DEVELOPMENT IN INDONESIA

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ABSTRACT

The focus of economic development in Indonesia shift from terrestrial to marine and coastal resources in the second long-term Development (1993-2018). The shift is due to the fact that 1) 63% (3.1 million km^2) of Indonesian territorial area is covered by marine waters which is rich in natural resources, and 2) terrestrial resources are becoming less and less and difficult to develop.

Experience in developing coastal and marine resource during the First long-term Development (1967-1992) result not only in economic growth but also environmental degradation. In some coastal areas, the degradation has come to a level that threatens the sustainability of coastal and marine ecosystems to support further Indonesia's economic development. Despite the environmental degradation, Indonesia can not stop the development of coastal and marine resources because this country still needs the economic growth to achieve a prosperous society.

The Challenge for coastal planners and managers in Indonesia right now is to develop coastal and marine resources for the maximum benefit and, at the same time, to maintain the sustainable capacity of ecosystems (meaning does not exceed the carrying capacity of the ecosystems). This paper discuss the definition of coastal zone carrying capacity and guiding principles for sustainable development of coastal resources in Indonesia

INTRODUCTION

As Indonesia embarks on its Second Long-term Development Plan (1993-2018), the focus of economic development is turned to marine and coastal resources. This is reflected in the 1993 State Policy Guidelines (GBHN) which consider marine and coastal-related development aspects as a sector in it. Before the 1993 GBHN, marine and coastal resources were only part of other development sectors.

The shift of development focus from terrestrial resource-based activities to marine resource-based activities is because of two main reasons. First, Indonesia is the largest archipelagic state in the world with 17,508 islands, 81.000 km coastline, and 63% (3.1 million km^2) of its territorial area is covered by marine waters which are endowed with diverse and rich natural resources. Second, although the pace of development in Indonesia is amongst the fastest in the world it is still heavily dependent on its natural resources. As the number of population increases (expected to reach 276 million by the year of 2020) and terrestrial (upland) resources are becoming scarce or difficult to develop, the role of coastal and marine resources will be more prominent in the Second Long-term Development Period.

Despite a bright prospect as indicated above, experiences in developing coastal and marine resources during the First Long-term Development Period (1967-1992) have resulted in not only positive benefits (economic growth) but also environmental degradation. The degree of environmental degradation in some coastal areas, especially those which are densely populated and industrialized areas, has come to a level that threatens the sustainability of coastal and marine ecosystems to support further Indonesia's economic development. Cases like increasing pollution levels in the Strait of Malacca and along the North Coast of Java; overfishing of some fish and shrimp stocks in the Strait of Malacca, the North Coast of Java, Bali Strait, and South Sulawesi; and excessive coral reef and mangrove damages indicate such a threatened condition.

The problem is that we as a developing nation can not stop development of coastal and marine resources, simply because Indonesia still needs economic growth to increase quality of life of those poor people and to achieve a just and prosperous society. Thus, the challenge for coastal planners and managers in this country is how to develop coastal and marine resources for the maximum benefit of the entire nation and, at the same time, maintaining the sustainable capacity of coastal and marine ecosystems. In other words, how do we develop and utilize coastal and marine resources which does not exceed the carrying capacity of coastal and marine ecosystems to support human existence and development.

DEFINING CARRYING CAPACITY OF THE COASTAL ZONE

Carrying capacity of an ecosystem such as coastal zone, is defined as the maximum population of a given species which can be supported on a sustainable basis (indefinitely), allowing for seasonal and random changes, without any degradation of the natural resource base that would diminish this maximum population in the future (Kirchner et al., 1985; Munn, 1989).

Based upon such a definition, carrying capacity of an ecosystem is then determined by the ability of the ecosystem to provide natural resources and environmental services (e.g. living space, recreational areas, clean air, and the ability of an ecosystem to dispose of wastes) required by population of a given species. For an animal population, factors that determine carrying capacity of an ecosystem may be only the availability of food and living space. Food availability is also a major factor which determine carrying capacity of a region inhabited by traditional (primitive) human population, since it can be a constraint to population growth. However, in modern societies (e.g. in highly concentrated urban areas) where food is readily available through trade with outlying areas, the carrying capacity is often determined by other factors, such as the availability of living space, potable water and clean air or the ability of urban areas to absorb wastes. A region's carrying capacity is, therefore, ultimately determined by its scarcest vital natural resources and environmental services needed by animal or human population who live in such a region.

Thus, if the carrying capacity of the coastal zone could be accurately assessed, then it would be possible to set the number of human population and the level (intensity) of economic development that could live and occur in the coastal zone on a sustainable basis. So far there has been very limited or no effort to define and measure carrying capacity of the coastal zone for human population and its development activities. As a result, our endeavor to realize sustainable development of the coastal zone has been approach mostly on an adhoc (piecemeal) approach, not on a comprehensive and holistic approach which is required for sustainable development.

Indeed applying the carrying capacity concept to human population and sustainable development is complicated by two major factors (Dahuri, 1991). First, natural resource consumption percapita and environmental services needed by humans are extremely vary, whether within the same society or among different societies competing for the same natural resources and environmental services. Second, human's ability to control or manage, to some extent, the natural resources and environmental services upon which they depend. Unlike other animal species, human beings can increase the carrying capacity of a region (including coastal zone) by using technological interventions and trade. However, people can also diminish the carrying capacity of a region through various forms of environmental miss-management leading to long-term natural resources degradation. Such human-induced degradation is due frequently to various short-term human's objectives, which occur largely in response to rapid population growth and excessive development activities to fulfill human's greed.

Through technological interventions, people can improve the productivity of natural resources and, thereby, expanding the region's carrying capacity. Technology can increase a region's carrying capacity in two ways (Kirchner et al., 1985). First, it can allow people to substitute, to some limited extent, a natural resource that is abundant for one that is scarce. Fertilizers, for example, allow farmers to compensate for a shortage of arable land by applying chemicals that are not in short supply at least until the petrochemical or coal feedstocks used to synthesize many of them become too expensive. Second, technology can increase the efficiency of conversion of natural resources into economic goods, thereby allowing people to "squeeze" more economic value from a given natural resources base.

While technological advances can expand the carrying capacity of a region to a considerable extent, they ultimately reach diminishing returns and do not make unlimited population growth possible. For example, at high application levels, fertilizers exhibit sharply declining marginal returns and cause serious environmental complications (such as eutrophication of lakes and coastal waters, and health-endangering nitrate levels in drinking water). At some point, increase in a fertilizer use will result in nutrient "poisoning" of crops and an actual drop in yields. By contrast, some production functions used in economic

analysis (such as the Cobb-Douglas function) assume that factors of production are infinitely substitutable for one another, and that using any resources more intensively guarantees an increase in output.

Moreover, technology cannot increase the total quantity of natural resources ultimately available on this planet. It can not create more raw materials out of nothing-nor can it increase the efficiency of conversion of these materials into economic goods beyond the constraints imposed by the physical laws of thermodynamics. For example, intercropping or rotation cropping of compatible species can result in greater food "outputs" from the same farm "inputs", but no conceivable combination of technologies could produce more food energy "output" than was available as (solar and other) energy "input" to the farm. Therefore, no technological advances can eliminate natural resource constraints entirely. Furthermore, technology cannot increase the Earth's natural waste assimilation capacity, although it can be used to reduce the volume of pollutants or other wastes that are generated. Thus, while technological advances can expand a region's carrying capacity to some extent, they cannot replace the need for eventual population stabilization. In the shorter term, the rate of population growth cannot exceed the rate at which technological advances increase carrying capacity without reducing people's standard of living and risking an overshoot of the carrying capacity.

Another means of pushing back natural resources constraints is trade. Trade can expand local carrying capacity by exchanging resources that are locally plentiful for those that are locally scarce. For example, countries in the Persian Gulf can support populations far in excess of their local agricultural carrying capacities by trading oil for food. Similarly, city-states such as Singapore and Hong Kong support population densities roughly 100 times higher than the local carrying capacity by paying for food with the value added to labor-intensive goods. In other words, trade allows one region to make use of the excess carrying capacity of another.

However, trade can expand local carrying capacities only in certain circumstances. The resource that is scarce in one region (for example, food) must be available in surplus elsewhere, and the region's plentiful resource for (example oil, phosphate rock, or cheap labor) must be scarce elsewhere. Trade cannot alleviate global scarcity, as there is no other "globe" nearby with which to trade. The difference in value between the exported and imported goods must be enough to pay the costs of transportation both ways, which for small, remote, or landlocked countries (or those lacking good internal transportation) can be enormous. Transportation costs are a particularly great obstacle to commerce in high-bulk, low-value commodities such as food staples or many raw materials. As fossil fuels become more scarce and their cost rise, many opportunities for trade are likely to become uneconomical because of higher transportation costs.

GUIDING PRINCIPLES FOR SUSTAINABLE DEVELOPMENT OF COASTAL RESOURCES IN INDONESIA

It is obvious by now that to achieve sustainable development of the coastal zone, it should be ensured that the number of human population and its associated development activities should not exceed the carrying capacity of the coastal zone. This is of highly relevant because carrying capacity of the coastal zone is generally difficult to be expanded by existing (available) technologies. This is particularly true in terms of the limited ability of the coastal zone to provide natural resources (fish and other marine living resources) and to absorb wastes.

Thus, sustainable coastal resources development can only be attained by bringing the population number (including its associated development activities) and the carrying capacity of the coastal zone into balance. In other words, economic development of a certain coastal zone can be sustainable only if the total human demand for natural resources and environmental services does not surpass the carrying capacity (functional ability) of such a coastal zone to provide them.

Any natural ecosystem, such as a coastal zone, provides four major functions to the existence of human beings and its economic development: (1) life-support services, (2) amenity services, (3) material inputs (the supplier of natural resources), and (4) waste receptor services (Ortolano, 1984). Life-support services include such things that are necessary for human existence as the provision of clean water and fresh air, hydrological cycle, tidal patterns, nutrient cycle, spawning and nursery grounds for marine biota, and space for living and development activities. Amenity services from the natural ecosystem can be found in the form of surroundings that people find pleasant, attractive and renewing, such as beautiful beaches and coral reefs. The coastal ecosystem can also supply natural resources that are required by human beings for their consumption and production processes, such as fish, mangrove timber, oil and gas, and other minerals. Waste receptor services offered by coastal ecosystems reflect their ability to transform wastes into harmless substances and dilute them.

Accordingly, from ecological perspectives, sustainable coastal resources development requires that

four main guidelines should be implemented when conducting the development of a coastal zone: (1) spatial harmony, (2) optimal utilization of natural resources, (3) pollution control, and (4) minimization of adverse environmental impacts.

Spatial Harmony

Spatial harmony means that coastal space (land and sea) should not be allocated entirely for intensive development activities, but should partly be set a side for conservation and preservation zones (Figure 1). In other words, a coastal zone should be divided into three zones: (1) preservation, (2) conservation, and (3) intensive development.

The preservation zone includes areas which have great natural values, usually due to some unusual or unique ecological attributes. Spawning and nursery grounds of marine fishes, a bird rookery (nesting area) of unusual and beautiful tropical birds, and a grove of exceptional virgin mangroves, for example, may be allocated for the preservation zone. Preservation zones are often extremely fragile and easily destroyed. The only types of alternative uses which might be compatible in this zone include scientific research, education, and limited recreation (ecotourism). Recreation activities which involve heavy foot or vehicular traffic may be too destructive to be permitted (Odum, 1976). At least 20% of the total area of a coastal zone should be set aside for the preservation zone. Mangrove green belt as defined by Act No. 24/1992 concerning Spatial Planning is one form of the preservation zone.

The conservation zone, which means a wise utilization of coastal resources, is intended for development activities that are based on the theory of maintaining and utilizing renewable coastal resources. Examples include managed mangrove forestry, hunting, and artisanal fisheries. Other development activities, such as recreation, low density housing and limited infrastructure constructions may be feasible at specified locations within the conservation zone. About 30% of the total area of a coastal zone should be allocated for the conservation zone.

The intensive development zone may be used for all types of "environmentally destructive development activities", such as refineries, factories, harbors, high density housing, intensive aquaculture and agriculture. Certainly, not all of these development activities are compatible and sub-divisions within this zone must be made. In certain cases, such as heavy industry, very little can be done to soften the impacts on the coastal environment other than preventing the most destructive influences such as pollution from affecting adjacent areas. In other cases, housing for instance, efforts can be made to retain as much as possible of the natural coastal ecosystems.

Furthermore, a spatial suitability concept can be applied to make sub-division within the intensive development zone. The spatial suitability guidelines basically require that each development activity should be located in an area of the coastal zone which is biophysically (ecologically) suitable for such a development activity. In other words, the spatial suitability includes integrated information regarding the conditions of the coastal environment including the types, extent (quantity) and distribution of its embodied natural resources which can be used to determine areas of the coastal zone that are suitable for a specific development activity. Any development activity which is located in a biophysically unsuitable area will likely be unsustainable. For example, the development of tambak (brackishwater shrimp/fish ponds) in areas with highly sandy-textured soils or highly acid soils (pH<5) most likely will be a failure.

In addition, the spatial suitability also implies the need to arrange all development activities within a certain area in such a way that their cross-sectoral impacts are minimized, and their total impacts (in the form of wastes, loss of biodiversity, landscape alterations, etc.) do not exceed the capability of the coastal environment to cope with.

Optimal Utilization of Natural Resources

When considering the coastal zone as a supplier of natural resources, the sustainability (optimality) criterion for their utilization is that no larger amount of renewable resources (e.g. fish stocks, seaweeds, and mangrove stands) be extracted than can be either produced or renewed over the same period of time (Clark, 1985). Meanwhile, the exploitation of non-renewable resources (e.g. oil and gas, tin, bauxite, and other minerals) should be undertaken with great care so that the associated impacts do not endanger the coastal environment. Another criterion for the extraction of non-renewable resources is, as pointed out by Goodland and Ledec (1987), that such an extraction rate should be kept slow enough so as to allow an orderly societal transition to renewable resources as substitute.

For example, because the utilization level of marine fish stocks is uneven among Indonesia's coastal/marine waters (Table 1), it is urgent to optimize (rationalize) or balance the utilization level according to sustainable capacity (MSY, Maximum Sustainable Yield) of fish stocks in each coastal/marine water of Indonesia. Muchsin et al (1993) has made an estimation on the optimal number of fishermen who can be economically and ecologically supported by marine fisheries resources on a sustainable basis for each Indonesia's coastal/marine water (Table 2).

Pollution Control

When treating a coastal zone as the receptacle of wastes, it must be ensured that all wastes from development activities both within the coastal zone and beyond its boundaries should not exceed its assimilative capacity. In this case, assimilative capacity means the ability of the coastal zone to absorb a certain amount of wastes before there is an unacceptable environmental or health hazards (Krom, 1986). However, for hazardous toxic wastes (B_3) should not be discharged into the coastal environment.

Minimization of Adverse Environmental Impacts

All development activities (projects) have some impacts on natural ecosystems (coastal zone), whether it is cutting mangrove forests, coral mining, changing river flows, extraction of ground water, intensive aquaculture, mass coastal tourism, and landscape modifications. Sustainable development of the coastal zone requires that all these environmental impacts should be minimized and not exceeding the tolerable limit of the coastal zone to cope with.

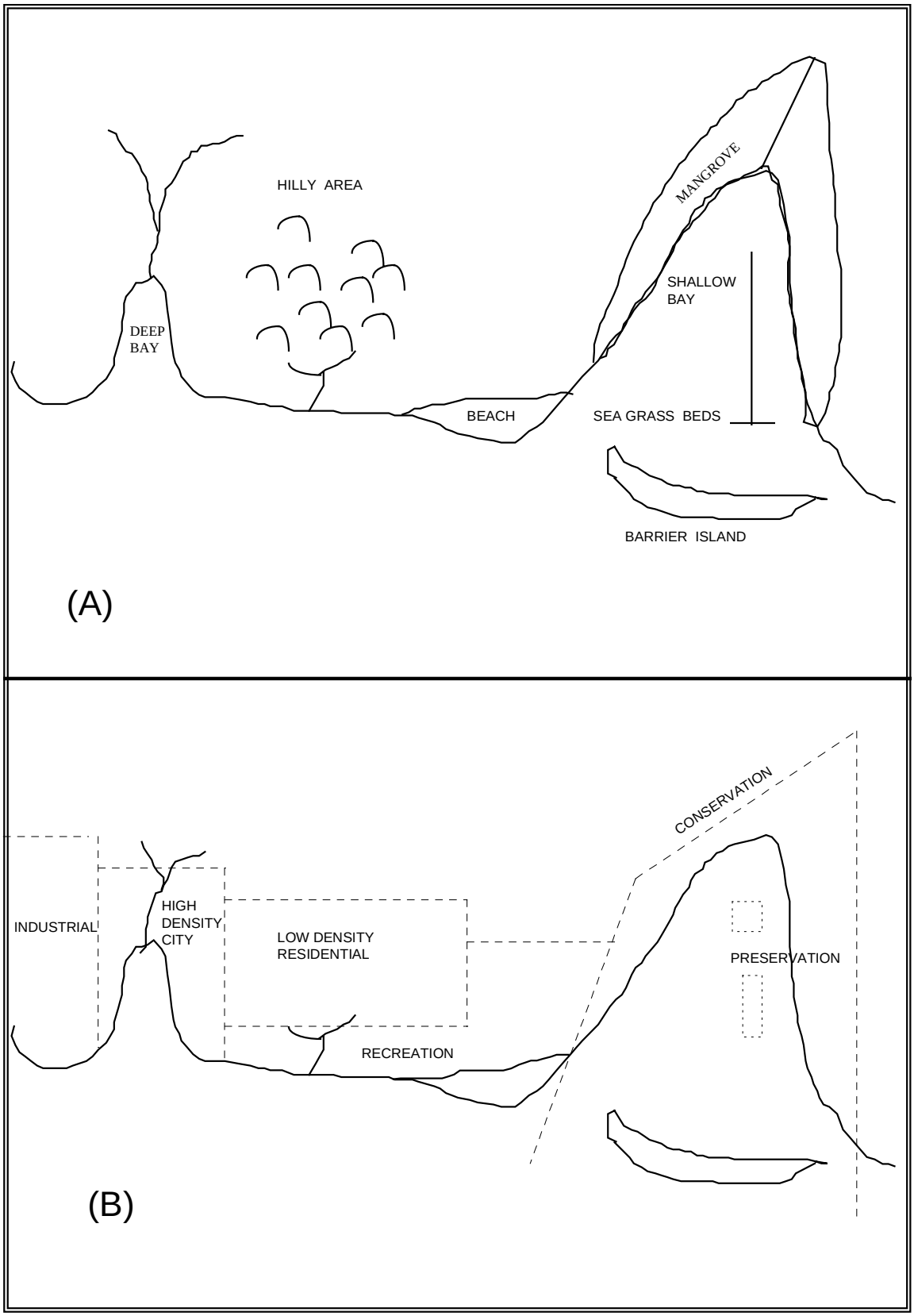

Figure 1. Natural conditions of a coastal zone (A) and its environmental zonation (Adapted from Odum, 1976)

Table 1. Summary of the status of exploitation of Indonesian marine fisheries resources based on landings data for the period 1975- 1979.

No.	Sub-area	1979 Production (x 10^3 t)	Total Standard effort	MSY (x 10^3 t)	Optimum effort	Level of exploitation
1.	Malacca Strait					
	Demersal					
	a. Demersal gear	152	2,571	167-188	1,438-2,092	Fully
	b. Demersal fish	86	2,571	137-248	833-1,758	Fully
	c. Penaeid shrimp	16	1,969	18	1,573-1,762	Over
	d. Other shrimp	50				
	Pelagic					
	a. Pelagic gear	84.6	963	70-90		Fully
2.	East Coast of Sumatera					
	Demersal					
	a. Demersal gear	29.7	220	27-28	227-247	Moderate
	b. Demersal fish	24.4	171	24-25	239-253	Moderate
	c. Shrimp	5.3	152			
	Pelagic					
	a. Small pelagic	57.4				
3.	North Coast of Java					
	Demersal					
	a. Demersal gear	116.9	1,642	124-170	833-367	Fully
	b. Demersal fish	105.6	1,642	114-160		Fully
	c. Penaeid shrimp	7.8	1,084	7-7	1,073-1,161	Fully
	Pelagic					
	a. Small pelagic	185.3	2,172	290-391	5,523-9,050	Lightly/Moderate
	b. Muroami Jakarta	0,9	16	1-1,1	17-20	Fully
4.	South and West Coast Kalimantan					
	Demersal					
	a. Demersal fish	37,2	1,709	34-35	1,636-2,050	Fully
	b. Penaeid shrimp	5,4	1,665			
	Pelagic					
	a. Small pelagic	29,8				
5.	East Coast of Kalimantan					
	Demersal					
	a. Demersal fish	32,8				Moderate
	b. Penaeid shrimp	5,5		3,4		Fully
	Pelagic					
	a. Small pelagic	37				Moderate

Table 1 *(continued)*

No.	Sub-area	1979 Production (x 10^3 t)	Total Standard effort	MSY (x 10^3 t)	Optimum effort	Level of exploitation
6.	West Coast of Sumatra					
	Demersal					
	a. Demersal gear	24,4	269	22-23	269-287	Fully
	b. Demersal fish	23,1	241	20-21	261	Fully
	c. Penaeid shrimp	1,3	188	1,5	209	Fully
	Pelagic					
	a. Small pelagic	39				
	b. Tuna	3,2				
	c. Skipjack	5,3				
7.	South Coast of Java					
	Demersal					
	a. Demersal fish	19,9	276	20,9	268	Fully
	b. Penaeid shrimp	4,9	157	4-6	106-119	Fully
	Pelagic					
	a. Small pelagic	16,4				
	b. Tuna	0,09				
	c. Skipjack	5,3				
8.	Bali-Nusa Tenggara-Timor					
	Demersal					
	a. Demersal gear	19,4	612			
	b. Penaeid shrimp	4,7	207			
	Pelagic					
	a. Small pelagic	48,7	464	47-49	494-582	Moderate/ Fully
	b. Oil sardine	24		36-38	190	Fully
	c. Tuna	2,3				
	d. Skipjack	1,3				
9.	South Coast of Sulawesi					
	Demersal					
	a. Demersal fish	46,3	203	34-42	102-187	Fully
	b. Penaeid shrimp	4,7	207			
	Pelagic					
	a. Small pelagic	132,5	1,910	114,8-	1,972-	Moderate/ Fully
	b. Flying fish roe	0,12	2,262 (pakaja)	0,15	2,000-2,700 (Pakaja)	Moderate
10.	North Coast of Sulawesi					
	Demersal					
	a. Demersal fish	10,8				
	b. Penaeid shrimp	0,72				
	Pelagic					
	a. Small pelagic	34,2				
	b. Tuna	2,9				
	c. Skipjack	8,5				

Table 1 (*continued*)

No.	Sub-area	1979 Production (x 10^3 t)	Total Standard effort	MSY (x 10^3 t)	Optimum effort	Level of exploitation
11.	Moluccas					
	Demersal					
	a. Demersal fish	16,6	207	18-18.2	344-421	Lightly/ Moderate
	b. Penaeid shrimp	5,1	165	5,1-5,2	146-153	Fully
	Pelagic					
	a. Small pelagic	25,8	1,268	27-32	1,645-2,262	Moderate
	b. Tuna	2,1				
	c. Skipjack	10				
12.	Irian Jaya					
	Demersal					
	a. Demersal gear	7,2	74	7-12	27-52	Fully
	b. Penaeid shrimp	4,9	54	4,7	39	Fully
	Pelagic					
	a. Small pelagic	6,4				
	b. Tuna	0,6				
	c. Skipjack	4,1				

Source : Dwipongo, A (1987)

Note : The levels of exploitation are adapted from FAO (1974).

Finally, it should be noted that development of coastal zone should be carried out through an integrated approach right from the planning to implementation stages. At present, planning and development in the coastal zone is often conducted in a sectoral basis, fragmented fashion frequently at great cost to the natural coastal environment. Rational planning and evaluation is therefore needed, through which environmental control can be formulated and implemented.

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MANAGEMENT OF COASTAL AREAS BY VILLAGERS OF JEMLUK, BALI ISLAND.

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ABSTRACT.

Deployment of the artificial reefs in Jemluk waters in Bali island paved the way to the local fishers to establish community-based coastal resource management (CBCRM). The performance of this CBCRM was evaluated in term of the productivity and distribution criteria. It was found that the implementation of the CBCRM brought about positive impacts as fishers landed more fish and distribution of landings of individual fishers tended to be more equitable. The establishment and implementation of the CBCRM also provided opportunity to fishers to work in tourism by bringing tourists for snorkeling and diving in the artificial reef areas. It was suggested to improve more villagers to participate in tourism by providing asset in the form of motorized boat.

INTRODUCTION

Utilization of coral reef ecosystems in Bali island have a long history (Subani, 1982. Subani and Wahyono, 1987). About 30 years ago, the living resources of the reef ecosystem were only utilized by the local people for their daily consumption. In line with the international demand for spiny lobster and aquarium fish, the commercial capture and the collection of these organism increased (Subani, 1981; Nikijuluw, 1988). Moreover, as demand for building material increased, the ecosystem was also utilized to provide housing materials. At present, coral ecosystem in Bali island are regarded as an important asset to attract tourists, especially those from other countries.

Of the many tourist destinations in Bali island, the hamlet of Jemluk is famed for its coastal waters which offers sport fishing, scuba diving, and snorkeling. Jemluk is a part of Abang District, the Regency of Karang Asem. Before becoming renowned as tourism spot, Jemluk was a modest fishing village whose coastal waters consists of coral reef ecosystem.

To regain the productivity of coral reef ecosystem which had been destroyed by illegal and uncontrolled fishing practices, artificial reefs were installed in the area. The installment of the artificial reefs appears to have brought about positive biological, economic, and social consequences. One of the consequences was the empowerment of local fishers in the management of the coral reef areas.

This paper describes people or community participation in coral reefs management. Community participation refers to fishers' direct involvement in coral reef resource management. The regime of resource management in which the local people are actively participating is referred to as the community-based coastal resource management (CBCRM). The impacts of CBCRM to Jemluk fishers, as the stakeholder in coral reef management, is evaluated in this paper.

METHODOLOGY

This study focuses on the CBCRM on the area of Jemluk where artificial reefs were installed. Identification and documentation of the CBCRM was undertaken by considering key variables as suggested by fishers (1993). Accordingly, in order that a community-based resource management system may exist, it should have essential and optional elements. The essential elements are the institutional base consisting of shared norms and behaviors. The optional elements is organizational structure. The type of resource management institutional arrangements can be examined in terms of contextual variables. Six contextual variables considered in this study are (1) biophysical attributes, (2) market attributes, (3) stakeholder attributes, (4) community context, (5) external institutional arrangement, and (6) external factors (Pomorey, 1993).

The performance of the CBCRM is a function of its ability to mobilize available resources and to use them productively, equitably, and sustainably in meeting the needs of community members (Korten, 1986). While it is true that productivity, equity, and sustainability criteria of the CBCRM should be evaluated altogether, in this study, however, only productivity and equity criteria were examined. This was done because of the lack of data for testing of sustainability criteria.

The field data collection was performed in May and June 1995 and March 1996. Respondents were 30 fishers who also engaged in tourism activities. In addition, information were also collected from village leaders and fisheries officers. A literature survey was conducted to gather data on the contextual variables of the CBCRM. Productivity (efficiency) and equity impacts were analyzed by estimating the mean, coefficient of variation and Pearson Skewness Coefficient (Walpole, 1982) of fish landing, fish price, operational costs of fishing, and day spent fishing.

RESULTS AND DISCUSSIONS

Fisheries and Marine Resources in Jemluk.

Jemluk is situated in the northeast of Bali island. The length of coast line under the Jemluk territory is about 2 km. The waters within 400 meters from the beach are designated for the activities of the villagers. The water bottom consists of living coral, sandy coral, muddy coral, and black sand. Wasilun et al (1993) estimated that black sand is about 180,000 m^2. Oceanographic condition of the Jemluk inshore waters cannot be separated from that of open waters. Wasilun et al (1994) stated that during the month of August, relatively cooler and higher salinity water from Banda Sea passes by the Jemluk area to the Java Sea. In the month of February, mud from Jemluk river floods the sea waters. This is the reason for the existence of muddy coral and black sand on the bottom of the Jemluk waters. Nevertheless, the waters are still clear because of the circulation process by the tidal waves (Wasilun, et al. 1994).

The type of human activities in the Jemluk coastal area are presented in Table 1. The coastal area in fact is used by the people for various purposes. Flat land is more intensively used than coastal waters, tidal areas, and upland areas. The coastal waters are mainly used for fishing and tourism activities. Artificial reefs were installed in the coastal waters as a part of the environmental, fisheries and tourism development programs. Garbage is dumped in a special place on the land. This help reduce problems from domestic waste-caused pollution.

The total population of Jemluk in 1996 was 567 consisting of 279 male and

287 female. The total number of household was 120. Therefore, on the average, there were five persons in each household. This household size was relatively higher than the national figure of approximately four person per household. The exact figures on age distribution of the population were not available. However, it could be observed that the number of young people in the labor force was relatively higher than other groups.

Almost all parents send their children to school. An elementary school (grade six) is available in the village. Children who want to go to high school may go to the district school. Unlike the situation that might be seen in other fishing communities, children in Jemluk were not so involved in helping their parents in fisheries-related activities. Beside studying, children's spare time is used for playing or learning dancing.

By origin, the residents of Jemluk came from Culik Village who moved to work as fishers. As tourism developed, people from surrounding villages, such as Tista and Bunutan, also came to live in Jemluk.

About 93% of the households are engaged in fishing, 3.4% in agriculture, and the rest in trades and services. Based on the livelihood pattern, Jemluk might be categorized as a fishing village. There are four families who rely on agriculture. On part time basis, they also engage in fishing as boat crew. Other families depend on small-scale trading, home industry, and tourism services.

Fishing activities in the village, however, are confined to the near-shore waters. In other words, fishers just exploit the fisheries resources in the waters traditionally considered as their territory. Going farther for fishing is almost impossible as the boats owned by fishers are without engine or with small engine.

The types of fishing gears employed by Jemluk fishers are troll line (261 units), hand line (261 units), bottom gill net (3 units) and drift gill net (12 units). One household can have more than one gear. Almost all families possessed a troll and hand line. Troll line was operated in the day while hand line was used both in the day and night. Drift gill net is relatively new gear, being used for only three year. The hand line is employed to catch demersal fish, the gill net is directed to catch pelagic fish.

Most of the fishers who use hand line and drift gill net fish for their subsistence needs. Commercial fishing and marketing is not the main orientation for these fishers. On the other hand, fishers who employ troll line and bottom gill net always sell their catch. The types of fish caught are mackerel, little tuna, pomfret, snapper, and grouper. All these fish are highly valued in the village market. There is no special fish auction market in the village, meaning that fishers are free to sell their marketable catch anywhere. The surplus of landings are brought to the village market which is visited by local consumers and middlemen from other places. The villagers can buy goods for daily needs from the village market. To buy belongings such as clothes, television, radio, or other luxury items, villagers go to larger markets in the district, regency, or province.

Of about 100 current fishers in Jemluk, 40% are engaged in the tourism sector by providing their fishing boats as excursion boats. The number boat and frequency of trips in tourism has steadily increased. In 1992, there were 324 excursion boat trips, increased about ten times to about 2400 trips in 1995. Not all fishing boats can serve as tourist boats. This is due to the fact that only motorized boat are demanded by tourist.

Table 1. People Activities in Jemluk Coastal Areas, 1995-1996.

Activities Identified during field surveys	AREA			
	Coastal	Tidal	Flat land	Upland
Fishing	XXX			
Tourism	XXX			
Artificial reef development	XXX			
Children ground play	X	XX	XXX	X
Boat mooring		XXX		
Gear repairmen		XX	XXX	
Settlement			XXX	XXX
Garbage dumping			XXX	
Animal pen			XX	XX
Plantation			XX	
Tourism base camp			X	
Market			XX	

Source: Primary data.
Remarks: X = low, XX = moderate, XXX = high. Types of fishing gears are torll line, gill-net, and hand line. Tourism includes snorkeling, scuba diving, and sport fishing.

Problem of Coral Reef Destruction

The regency of Karangasem once was renowned as an area whose waters were covered by live corals. People used coral for various purposes. Of the total 400 coral mining enterprises in Bali island operating in 1981, 125 were located in Karangasem, 208 concentrated around Denpasar, and the rest scattered in other parts of the island. It was reported that materials for coral mining in Denpasar were supplied from Karangasem regency (Subani, 1982).

Coral were also used as brick and road materials. Subani (1982) reported that although there was a Provincial Decree Number 02/PD/DPRD/1973 to ban the collection of corals as building materials, the rule was ineffective as there were violations of the rule. The efforts to implement the rule was hindered by the fact that many villagers built their livelihood on this activity. It was reported that 2880 people worked in coral mining in 1981.

The destruction of the coral ecosystem in Bali island, especially in Karangasem regency was also caused by the development of the ornamental fish industry. Villagers in Jemluk caught ornamental fish. Fishers from Sumber Kima and Tejakula in North Bali also came to catch aquarium fish in Jemluk waters. The development of the ornamental fish industry was accelerated by the fact that access to international markets was easy as there were flight services from Denpasar to various international cities.

Most of the ornamental fish are coral residents. Other species like snapper and grouper temporally stay in coral reefs, particularly when they are young. The habitat of coral reefs provides food and protection for all these fish.

Unlike consumption fish, to catch ornamental fish is more difficult as the fish can hide in the holes of corals and they must be alive. Fishers in Jemluk and other parts of Bali used cyanide to catch ornamental fish (Nikijuluw, et al. 1988). Nevertheless, fish can still run to hide inside the coral

reefs even though they have been sprayed with cyanide. To get the fish, the coral is broken.

As a consequence of such coral reef exploitation, coral fish resources were degraded. Subani (1982) asserted that both production and number of species of sea weed, mollusk, and crustacean, especially spiny lobster, decreased. The poor state of fish resources was exacerbated by the fact that fishers fish primarily in near shore waters and do not go farther offshore.

Deployment of Artificial Reefs.

To regain the previous state of fish resources in the area, artificial reefs were introduced and installed by the provincial government through the Local Fisheries Service, the Directorate General of Fisheries (DGF), and collaboration with the Research Institute for Marine Fisheries (RIMF). In 1991, 3 units of pyramid modules made of open concrete cubes were installed by the RIMF. After being evaluated and found that the installment of the reefs brought about positive impact to fish availability (Wasilun, et al. 1993), another 4 units of artificial reefs were placed in 1992. In addition, the Local Fisheries Service assembled 11 units of pyramid modules made of old tires and concrete. Hence in total there were 18 modules of artificial reefs installed in Jemluk waters covering an area of about 217 cubic meters.

Deployment of artificial reefs in Jemluk waters was a part of the Coastal Waters Development Project of the Provincial Fisheries Service. It was stated that the main objective of the artificial reef deployment in Jemluk was to provide substitute for destroyed coral reefs. The secondary objective was to have habitat or shelter for fish and other marine organism (Diskan, 1994). The objectives, however, do not cover the whole ranges of the ecological and socioeconomic features of artificial reefs. The ranges of objectives of an artificial reefs deployment as revealed by Munro and Balgos (1995), taking from the cases of the Philippines, are as:

- habitat or shelter for fish and other marine organism
- substrate for regeneration of corals and other marine organism
- feeding, breeding and nursery area
- reference point
- deterrent to trawling
- eco-tourism and other recreational purposes
- waste disposal
- mariculture
- fishing ground
- sanctuary
- substitute for destroyed coral reefs
- entry point for coastal management initiatives
- focus for propaganda purposes of vested interest groups
- replenishment area
- provide a known and easily located fishing area.

There was no biological base line study purposely conducted before the deployment of the artificial reefs. However, monitoring on the kind of abundance of fish was conducted after reefs had been deployed. Two months after the first installation, 28 families consisting of 114 species of fish were found in the artificial reefs (Wasilun, et al. 1993). The abundance of fish in the artificial reefs also increased. In October 1991, it was found that the abundance of of fish was 5 pieces per meter cubic, It increased to 61 pieces in August 1992. Based on the abundance of fish, it can be said that the artificial reefs have functioned as fish habitat.

Establishment of CBCRM

Villagers of Jemluk were involved in construction and placement of the artificial reefs. The monitoring of the biological impact of the artificial reefs also involved some fishers. Extension services to the villagers on the function of the artificial reefs before and right after their deployment were carried out by the Provincial Fisheries Service. The impact of the extension services is that community awareness to manage coral reef resources improved.

Management of the coral reefs and their fish resources essentially is under government responsibility. In chapter 18 of the National Law (UU) No. 4/1987 about the Principal Guidelines of Environmental Management, it is stated that the management of the environment and natural resources are undertaken in a coordinated manner by a ministry at the national level, by sectoral departments in accordance with their respective tasks, and by local government at the provincial level. In chapter 5 of the Law No. 4/1987, it is stated that every person is responsible to care for his (her) environment, and to protect and cope with damage and pollution. The role of non-governmental organization (NGO) as a partner of the government is also appreciated in environmental management.

The provincial government of Bali issued the Local Code (Perda) No. 3/1985 about Fishery Resource Conservation. Accordingly, every person is responsible to maintain and conserve fish habitat. Fishers are disallowed to catch fish by using explosive, poison, electric current, and other equipment which can damage fish resource.

Without realizing the legal basis for individuals and society to manage their environment, the villagers of Jemluk developed their own mechanism to manage the deployed artificial reefs and their surrounding waters. The villager-initiated resource management system was started by the establishment of the Tunas Mekar Fisher Association (TMFA) whose members consist of fishers who also work in tourism. The TMFA has an executive board consisting of one coordinator, one secretary, and one treasurer.

After the installment of the artificial reefs, tourist were attracted to visit the area for snorkeling and scuba diving. While Jemluk had been visited by tourists since 1982, the visitation rate rose after the construction of the artificial reefs.

The coming of tourists to the village meant that other economic opportunity was created . Fishers who formerly relied on only fishing could diversify their livelihoods by offering their boats to bring tourists for snorkeling and diving. In order to provide better services to tourists, fishers formed the TMFA. The formation of this organization came about because many tourists came to the area and the fishers compete against one another to offer their services. The competition among fishers to serve tourists made for uncomfortable conditions for the tourists. With the formation of the TMFA, conflict was avoided because fishers could serve the tourists according to their agreed schedule.

The membership of the TMFA is restricted to those having motorized boats and commitment to provide better service. Furthermore, each member pays Rp 150,000 as a membership fee. Due to the motorized boat requirement, only about 40% of fishing household have the ability to join the TMFA.

Although only around 40% of fishing households joined the TMFA, the other fishers and residents of Jemluk paid respect to managing the area as a tourist destination in Bali. In this regard, villagers, under the supervision of the Local Fisheries

Service, the Tourism Department, and the Local Police Station, establish their own rules and regulations concerning utilization and management of the Jemluk waters, especially coral reef areas.

For those who did not join the TMFA, benefit could still be derived from fishing in the artificial reef areas especially when they could not go farther offshore for fishing due to bad weather. In addition, since members of the TMFA were not fishing because of being scheduled for tourism, the remaining fishers has a greater chance to catch fish. In technical words, it implied that the establishment of the TMFA and the installment of the artificial reefs have brought about a positive impact to fishers in the form of less fishing effort.

Under those coastal waters management measures, pressure on the resources seemed to be reduced. In fact, construction of the artificial reefs made the resource more productive. The pristine condition of beaches was gradually regained. In sum, it might be said that the new approach to resource management, based on villagers participation (CBCRM), has been effective. The artificial reefs which were developed to replace destroyed coral reefs and provide alternative fish habitat have also functioned as fishing ground for small-scale fishers, eco-tourism and recreational areas, and an entry point for community-based management initiatives.

Implementation of the CBCRM Rules.

Table 2 provides basic rules or regulations initiated by the villagers for the purpose of the management of Jemluk waters. The rules are applied to both members and non-members of the TMFA. The rules dealing only with the activities of the TMFA members are written in the TMFA constitution and presented in Table 3.

Every villagers is strictly prohibited from dumping garbage in the sea and litter on the beach. Cleanliness, neatness, and tidiness of the environment are intensively promoted by the provincial government in a bid to attract more tourists to visit Bali. To maintain the cleanliness of the beach, members of the TMFA are obliged to clean the beach once a month. If that is not possible, the member should inform the association beforehand and pay Rp 250 as a penalty. The penalty of Rp 250 per violation is so low that every member may be able to pay it. Nevertheless, this penalty is not a reason to make members of the TMFA abandon their obligation. In other words, members of the TMFA do not have the intention to break the rule although they can undoubtedly afford the penalty payment.

Table 2. Basic Rules Initiated by Villagers on the Management of Jemluk Coastal Areas.

Objective of the Rules	To manage Jemluk waters so that they can be utilized as a source of people livelihood.
Rules	• Unlawful to dump garbage at sea. • Prohibition to take coral heads and catch ornamental fish • Abolishment of using cyanide, other poisons, dynamite, bomb, and destructive fishing gears and methods. • Area under the CBCRM is the waters within 35 meter depth from the coast line of about 2 km length.
Process of the Rules establishment	• The rules are stipulated by community convention under the supervision of the Fisheries Service, Tourism Depaertment, and the Local Police Station. • The rules are unwritten. • Monitoring of the rules and patrol are performed by the villagers. • Enforcement of the rules is under the auspices of the Local Police.

Source: Primary Data.

It is also prohibited to take coral for any purpose and catch ornamental fish for commercial use. The rules are apparently well-respected by villagers, as taking coral for building materials and catching fish in reef areas were common practices in the past. The villagers are also prohibited from using destructive fishing practices such as poison, cyanide, dynamite, and spear. The area under this CBCRM arrangement are the waters facing the village, about 2 km along the beach up to 35 meters depth offshore.

It is showed in Table 3 that member of the TMFA are forbidden to fish in artificial reef areas. The non-members, in contrast, can fish in the artificial reef areas as long as they use permitted fishing gears and when there are no tourism activities around the reefs. The capture of ornamental fish were strictly prohibited in the artificial reef areas. Tourists generally do not wish for waters around the artificial reefs to be used as fishing ground, so that when fishers area encountered operating in the waters around the artificial reefs, they area normally driven away.

There is tendency of growing number of tourists to visit to Jemluk. Is happened without real effort of the villagers to promote their area. The promotion of tourism in Jemluk may be executed by the Tourism Department in Denpasar. However, it is also possible that the information about diving and snorkeling in Jemluk waters are passed on by tourists themselves. The larger number of tourists, the less number of boats go out fishing.

Monitoring, control, and surveillance of the aforementioned rules and regulations are undertaken by villagers themselves. It should be mentioned that there is no special organization or person assigned to the implementation of the village rules and regulations. Fishers, both member and non-member of the TMFA do patrol by themselves. Local police are responsible for backing up the villagers so that they follow the rules. It appears that the rules are effective since there are no reported cases of rule-breaking.

Table 3. Rules and Regulations of the TMFA in Jemluk.

VARIABLES	DESCRIPTION
Name of Institution	Tunas Mekar Fisher Association (TMFA)
Objective of the Institution	• Conserve and manage coral reefs for tourism activities. • Increase income of the members
Rules / Regulations	• Obligation to cleanse the beach once a month. • Prohibition to catch fish in the waters and artificial reef areas destined for snorkeling and scuba diving. • Unlawful to go fishing for the fishers who have been scheduled to bring tourists.
Behavior	• The rules and regulations are enacted in the TMFA constitution. • Monitoring and patrol are undertaken by the TMFA members. • Implementation of the rules and regulations are under responsibility of the executive board.

Source: Primary Data.

For the case of rule-breaking in the TMFA, the executive board is responsible for imposing penalties. The types of penalties range from reprimand to fine. Members of the TMFA will be fined if they are absent from community work to clean the beach.

Impact Analysis on the CBCRM

Performance of a CBCRM is a function of its ability to direct people to utilize the resource in order to fill the needs of the people on a sustainable, efficient, and equitable bases. These three criteria should be given an equal weight in evaluation. In other words these three criteria should be evaluated altogether.

Fishers in Jemluk have derived benefits from the establishment and implementation of CBCRM in their area. The derived benefits are as follow:

1. There is an opportunity for fishers to catch coral (demersal) fish in waters of deployed artificial reefs by using hand line;
2. Fish production increases;
3. Villagers diversify their livelihood by working in tourism-related activities;
4. Income increases; and
5. Increase fish production and income have a tendency to bring equity.

The opportunity to catch coral and demersal fish has been regained by fishers because the use of destructive and illegal fishing methods on coral reefs has been stopped. Since the CBCRM has been practiced , following the installation of artificial reefs, the abundance of coral fish has increased. This was traced to the increases of fishing landings. Some fishers who previously did not catch coral fish now have a chance to do it.

Fishery production figures before and after CBCRM are presented in Table 4. The figures for before CBCRM are illustrated by the recalled information of fishers back to 1990. The figures for after CBCRM are presented by information for the years 1995/1996. Based on the figures in table 4, it can be concluded that the CBCRM resulted in a positive productivity impact as shown by an increase in demersal fish production from 3.9 kg per trip to 13.3 ke per trip. The pelagic fish productions, on the other hand, tended to be the same as depicted by their mean. However, based on the median of the pelagic fish production , it can be inferred that more fishers caught

above the average production. Hence it may also be inferred that production of pelagic fish was slightly improved.

Table 4. State of Fisheries in Jemluk Before and After CBCRM.

Variable	Before CBCRM, 1990	After CBCRM ,1995/1996
Demersal fish production:		
• Mean	3.9 kg.	13.3 kg.
• Standard of deviation	2.4 kg	5.6. kg.
• Median	5.0 kg	15.0 kg.
• Skewness coefficient	1.4 kg.	0.9 kg.
Pelagic fish production:		
• Mean	36.0 kg	35.0 kg
• standard of deviation	22.3 kg.	14.4 kg
• Median	30.0 kg.	32.5 kg
• Skewness Coeeficient.	0.8	0.2
Mean of fish price:		
• Demersal	Rp 500 per kg.	Rp 2000 per kg.
• Pelagic	Rp 170 pet kg.	Rp. 2250 per kg.
Mean of operational costs:	Not	Rp 2250 per trip.
Fishing gears used:	troll line, hand line.	troll line, hand line, gill-net.

Source: Primary data.
Remarks: Production figures are landings per trip. Labor cost is excluded from the operational costs.

The use of gill nets by fishers in Jemluk may be regarded as another effect of the installation of the artificial reefs. Beforehand, fishers only employed troll line and hand line using hand-paddled boats. After the installation of the artificial reefs, bigger and motorized fishing boat were used to respond to tourism-driven demand. Operating bigger and motorized boats, fishers can reach farther fishing grounds and use drift gill net to catch pelagic fish. Since offshore fishing grounds can be reached, the fishing period for pelagic fish can be extended from six months to nine months a year.

Efficiency may also be evaluated on the basis of the changes in fish price received by fishers. In Table 4, it can be seen that the nominal price of demersal fish increased four times from Rp 500/kg to Rp 2,000/kg. The price of pelagic fish also increased from Rp 710/kg to Rp 416/kg.

The five year price data comparison should not be done without being deflated by a price index. In other words, in such a comparison the general price change or inflation should be taken into consideration. Say that inflation rate is 10% a year, after five years prices should have increased by 50%. Since demersal and pelagic fish prices increased by 400% and 240%, respectively, it may be inferred that there was still a net increase in price. The increase of the fish price may be also attributed to the tourism development which raised the producer prices.

From the increase in the amount of average fish landing and the fish prices, the gross revenues of fishers increased. This increase is another proof that the current

system of coastal waters management brought about positive impact to the fishers.

Under the CBCRM, fishers spend about Rp 2,250 per boat every time they go fishing for gasoline. Before the CBCRM, fishers did not use an engine and therefore there was no expenditure for oil and gas. Therefore, implementation of the CBCRM did not only change the technology used but also the pattern of inputs used and fishing expense.

The equity impact of the CBCRM might be judged by virtue of the coefficient of variation. In Table 4, it can be seen that after or with the CBCRM, the production of demersal and pelagic fish bore smaller coefficients of variation, meaning that fish production become more equal among individual fishers. The Pearson skewness coefficient tended to be closer to zero, implying that production per individual fishers did not vary so much with the implementation of the CBCRM. Hence, it could be said that implementation of the CBCRM in Jemluk brought about improved equity to the members of the TMFA.

The variation of landings may be explained as follow. Before the deployment of the artificial reefs, fishers only caught fish in the waters around destroyed coral reefs. Operating hand line and troll line, they competed with one another for limited fish resources available in inshore waters. Under such circumstance, catch depended very much on the skill of fishers. It was also a situation that who came first to the fishing ground had better chances to fish than those coming later. Therefore, landings of individual fishers would vary. After the deployment of the artificial reefs, fishers operated bigger and motorized boats and used gill net as a fishing gear. They had the ability to enter offshore fishing ground which offer more fish. Competition was not so tight and as a consequence landings of individual fishers was not so different.

CONCLUSION AND POLICY IMPLICATION

Conclusion.

The villagers of Jemluk can be categorized into those who area only fishers and those working in fisheries and tourism. The first group are the fishers employing non-motorized boats and using hand line and troll line as fishing gears. The second group consists of the fishers owning motorized boats and operating troll line or gill net as fishing gears. The second group of fishers area organized into TMFA.

CBCRM has been established and implemented in Jemluk coastal waters. The establishment of the CBCRM was initiated by villagers in a bid to enhance the quality of the waters which years before had been degraded due to destructive practices. Another objective of the CBCRM is to improve well-being of the villagers. The establishment of the CBCRM can be regarded as a follow-up to the installation of artificial reefs in the area. The coming of tourists for snorkeling and diving in the waters of Jemluk can be considered as an impulse or another reason for the establishment of the CBCRM.

The CBCRM is a set of local rules and regulations on the management and utilization of the coastal waters. The rules and regulations include the type of allowable fishing gears and methods, time of fishing, area of fishing, and obligation of the villagers to utilize the coastal area. Moreover, the CBCRM also deals with tourism activities in the waters around the artificial and living reefs. The CBCRM rules and regulations which relates to the members of the TMFA are written in the TMFA constitution. The rules dealing with all villagers of Jemluk are unwritten. There is no penalty system for the rules and

regulation applied to all villagers. However, there are penalties for violations performed by member of the TMFA. The rules and regulations are effectively implemented since there are no reported violations.

Villagers area involved in monitoring , control, and surveillance of the implementation of the rules and regulations. The enforcement of the rules and regulations are undertaken with the local police. The executive board of the TMFA is responsible for enforcing the organization rules and regulations.

The impact of the CBCRM to the villagers was evaluated based on efficiency and equity criteria. It can be inferred that the CBCRM brought about a positive efficiency impact shown by bigger catches landed by fishers. The efficiency impact of the CBCRM could also be judged on the fact that non-members of the TMFA could have a chance to catch demersal fish in the inshore waters.

The establishment and implementation of the CBCRM improved the quality of marine resources and environment, indicating an achievement of sustainability criteria of the CBCRM. The baseline data on biological aspects indeed were not available. However, basing on the monitoring survey starting right after the artificial reefs deployment and the comparison of catch before and after the establishment of the CBCRM, it may be concluded that there was a positive biological impact. Nevertheless, one should keep in mind that the long term biological impact might be negative, if there is no control of fishing effort in the artificial reef areas. Providing that eco-tourism is further developed, the existing fisher may keep on moving to tourism sector. Under such circumstance, fishing activity will have less pressure and therefore it will sustain or improve ecological condition of the coastal areas,

Equity impact of the CBCRM was assessed on the basis of the coefficient of variation and Person' Skewness Coefficient taken for the amount of fish landings. The two coefficients asserted that the CBCRM resulted in less disparity of catch distribution.

Policy Implication

Major beneficiaries of the CBCRM in Jemluk seem to be members of the TMFA. Other villagers received benefits from fishing as they now catch demersal fish by employing hand line. However they could not generate income from tourism because of limited assets. It can be concluded that the establishment of the CBCRM in Jemluk resulted in a bigger proportion of economic activities to the members of the TMFA . While non-members still had improved income, it was limited to that received from fishing. The implication of this is that if motorized boats could be provided to the non-members of the TMFA, they could join the organization and consequently enjoy the benefit of tourism.

To anticipate more fishers joining the TMFA, tourism should be promoted. In addition to the snorkeling and diving offered in Jemluk, there should be also efforts to make tourists stay longer and spent money in the village. Thus far, tourists only came from Denpasar for snorkeling and diving then go right back to Denpasar. If accommodation facilities were made available in the village, an increased influx of tourists into the village might occur.

The local government, through the Provincial Fisheries Service and/or the Provinvial Tourist Promotion Office should consider the possibility of developing additional artificial reefs. Learning from experience, deployment of additional

artificial reefs should have clear objectives and a management plan. Since Jemluk has tourism potential, one of the objectives of the artificial reefs deployment is to promote tourism. By specifying this objective, commercial fishing activities in the artificial reefs should be totally closed and displaced fishers can become involved in tourism. A subsidized credit scheme should be provided so that bigger and motorized boats can be afforded.

The installment of the artificial reefs is under the responsibility of the government. However, management of deployed artificial reefs can be handed over to villagers. In the case of Jemluk , TMFA can be an embryo to develop a bigger CBCRM organization which embraces all the fishers in the village.

In order to develop additional artificial reefs, biophysical characteristics of the waters should be examined to determine proper location and number. The artificial reefs should provide long term benefits.

Compared to other fishing communities on Bali island, Jemluk is small. Therefore, practices of the CBCRM in this hamlet will have limited impact on the management of coastal areas and inshore waters on Bali island. It is possible that other coastal village have their own systems of coastal management. Identification of such systems, therefore, is required so that an overall system of CBCRM for the whole island may be derived.

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Preliminary Results of Participatory Manta Tow Training: Blongko, North Sulawesi

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ABSTRACT

Training for a community-based coral reef monitoring program was carried out in the village of Blongko, North Sulawesi. A manta-tow based method was selected because it is a relatively simple technique to enable the community to determine whether coral reef conditions are becoming worse, better or staying the same. Data collected by the community was compared with data collected by independent professional survey. The correlation coefficient, r, between the two data sets is 0.825. A matched pair t-Test was performed on the two data sets and the difference between the two was determined to be not significant ($p>0.05$). These preliminary results compare favorably with the other volunteer-professional data comparisons from the United States (USEPA, 1990); the value of the correlation coefficient is likely to increase with an increased sample size.

INTRODUCTION

Community-based monitoring of coral reefs is becoming a common practice in coastal-zone management plans (e.g. McManus et al., 1997; Smith, 1994 and Buhat, 1994). American volunteer water-monitoring efforts, many of which started in the mid-1980's, have a successful record of generating accurate and precise data (USEPA, 1990).

A common criticism amongst the professionally trained scientific community is that community-based volunteer monitoring programs are incapable of providing accurate and useful results. In order to avoid such pitfalls, it is necessary to create a thorough plan detailing: (1) what the communities needs are, (2) what data is necessary and (3) what tool to use given time, equipment, education and skill constraints.

After a method has been selected the next items to be addressed include: how are the volunteers to be trained, the results presented, the program to be evaluated and data quality assurance maintained. An evaluation of two community-monitoring programs (New Hampshire Lakes Lay Monitoring Program and Massachusetts Acid Rain Monitoring Program) compared professional and community generated data. The two programs had correlation coefficients, r, of 0.94-0.99 (USEPA, 1990). These high correlation coefficients indicate the quality of community generated data is comparable, if not equivalent, to the quality of professionally generated data. Therefore, if a community-monitoring program is properly planned, trained, supervised and evaluated, these data quality concerns can be addressed.

The "Manta Tow" method is described in detail by the English et al., 1994. The manta tow method was selected for community-based reef monitoring because it fulfilled the following requirements of the project:

1) to establish baseline conditions where no prior data exists
2) to determine qualitatively the percentage of coral cover and changes through time
3) to increase community awareness of coral reef conditions and humans affect reefs.

The community manta tow surveys were supplemented by professional manta tow surveys for evaluation purposes. In addition, more detailed professional surveys (line-intercept transects, coral types) were conducted by professional researchers for the project's base-line data purposes.

FIELD SITE

The village of Blongko, in North Sulawesi, is situated approximately 27 km west of the town of Amurang, it has a semi-sheltered sandy bay with sediments dominated by the sand brought down by the Laimpangi River. A series of fringing reefs are found around the perimeter of the village, as well as healthy stands of mangroves (Avicennia spp. dominate). The community of Blongko is economically dependent on its coastal resources. Approximately 55% of the population are fisherman (Pollnac et al., 1997). Larger vessels target offshore pelagic fish, however fishermen use other methods to gather fish from the coral reefs: paka-paka (small drift, gill net) rarape (bottom-set gill nets with stakes at either end) and bodo (drift gill net). Jubi (spear-fishing) fishermen collect 20-30 kg per day fishing off the coral reefs (Pollnac et al., 1997). Reef fish are still of good size but the community is concerned because of increased population pressures forcing fishermen from other villages, notably those near the overfished Amurang Bay, to fish near the village of Blongko. Therefore, the status and health of the coral reef and changes over time were considered to be of utmost importance and the focus of further efforts for community-involvement.

TRAINING

Three officers from the "Proyek Pesisir" in North Sulawesi were involved with the training of 13 Blongko villagers: Mediarti Kasmedi, Audrie Siahainenia, Nicole Fraser. Before the training sessions, a manta tow "board" was built by A. Siahainenia and Ismet Maliasar, kepala dusun III. The six training sessions took place over a period of four days (November 10-13, 1997). The thirteen students were comprised of nine males and four females. Every session was concluded by an "evaluation" by the students of all the instruction and afterwards followed up by a critique by the three staff trainers.

DATA COLLECTION

The manta tow survey was conducted on the final day of training, November 13, 1997. Two-minute transects, approximately 150 meters long, covered the coastline of Blongko. Physical factors, such as engine speed and currents, may affect the number of transects collected for the same area (English et al., 1994). However, if the start and end points for each transect is marked, two manta-tow data sets may be compared for evaluation.

The community undertook surveys of 39 segments of the coastline of Blongko village and rated the percentage coral reef cover for three components for three organism categories (e.g. live finger coral, brain coral or soft coral) on a scale of 1-5. Protocols for data collection differed slightly between the community and professionally collected data. Firstly, the community used geographic landmarks to define the boundaries of 39 transects. Whereas, the professional researchers used GPS to mark the boundaries of 25 transects. Therefore, coral reef cover data from the community was consolidated so that the transects matched that of the professional data (see Table 1). Secondly, data collected by the community were collected for three live components which were then converted into a single coral reef health statistic on the same scale. Data collected by professionals consisted of absolute percentage cover categories for live soft and hard coral. These percentages were then

summed then converted to the same scale (1-5) as the community data for comparison.

EVALUATION

A paired two sample means t-Test was performed on the data collected by the community under supervision of a researcher, versus data collected by the professional researchers at the same site. In order to use the matched pair t-test, coral reef areas were standardized using the start and endpoints from the two data sets. Due to physical factors the community data had many more two-minute transects than the professional data. Therefore, in some instances the same area of coral reef the community completed two two-minute transects and the professionals one two-minute transect (e.g. profession #13 and community #20& #21). The community coral cover category for the two transects was averaged for comparison with the professionals The resultant t-statistic was 2.753, with a p-value of 0.006 (Table 2). For an alpha value of 0.02 (90% confidence interval) this value suggests that the difference between the two data sets is not significant (t-distribution table from Wardlaw, 1985). The pearson correlation, r, between the two data sets is 0.825.

DISCUSSION

Three major issues became clear during the training session: quick response, free environment and the necessity for graphic aids. It is imperative to respond to the training activity by creating a final group report (in this case a map) the same day that the data was collected as was done in Blongko. Volunteers require feedback and reinforcement. The official certification by the kepala desa, served as a verification and commendation of their efforts. Creating an environment where younger men and women feel free to express opinions, or to speak at all is difficult if there are too many older men dominating the conversation. Dividing the larger class into smaller working groups will help the more timid students to express themselves. More graphic aids for examples of percentage of coral covers (photographs) and organisms (line drawings) may help in the early introduction of the more confusing aspects of the training. These graphic aids could be potentially part of a training "kit" available for training teams in other villages.

CONCLUSIONS

Preliminary data suggests that the difference between supervised community and professional surveys is statistically insignificant. Therefore, data from the supervised community-based monitoring using manta-tow techniques can be considered reliable for a qualitative assessment of reef conditions. In those cases where a discrepancy occurred between the professional and community surveys, the community surveys had underestimated the amount of coral cover by one category value (Figure 1). The disparity between the two protocols for data collection (professional vs. community) may also have influenced the correlation. A follow-up manta tow survey is planned for March of 1998 to allow the community to collect the data unsupervised and also standardize the data collection for a more detailed comparison between community and professionals to maintain data quality.

For seven of the thirteen students, this was their first experience viewing coral reefs less than 50 m away from their homes. This single activity was an immense success in helping to foster the community's sense of stewardship and responsibility over their coral reef resources.

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Table 1. Data collected by the community with supervision of a professional researcher compared to that data collected by the professional researchers.

Professional			Community	
Transect #	Coral Cover Categories	Transect #	Coral Cover Categories	Difference
1	3	1	3	0
2	3	2	2	1
3	4	3	4	0
4	3	4 & 5	3	0
5	3	6 & 7	2	1
6	2	8 & 9	2	0
7	2	10 &11	2	0
8	3	12 &13	2	1
9	3	14	3	0
10	2	15 & 16	2	0
11	1	17	1	0
12	2	18 & 19	2	0
13	2	20 & 21	2	0
14	3	22	2	1
15	3	23	2	1
16	2	24 & 25	2	0
17	1	26 & 27	1	0
18	1	28	1	0
19	2	29 & 30	2	0
20	3	31 & 32	3	0
21	2	33 & 34	2	0
22	3	35	2	1
23	2	36	2	0
24	2	37	2	0
25	3	38 & 39	3	0

n.b. - The data was collected on a 1-5 scale of coral cover where 1 = 0-19%, 2 = 20-39%, 3 = 40-59%, 4 = 60-79% and 5 = 80-100%. The difference between the two coral cover categories was used for the subsequent t-test.

Table 2. t-Test for paired two sample for means at alpha =0.1

	Professional	Community
Mean	2.4	2.16
Variance	0.583	0.473
Observations	25	25
Pearson Correlation, r	0.825	
Hypothesized Mean Difference	0	
degrees of freedom	24	
t Statistic	2.753	

BOOK REVIEW

John R. Clark (1996) Coastal Zone Management Handbook, Lewis/CRC Press, Boca Raton, Florida, 694pp. ISBN: 1-56670-092-2, RRP US$89.95

John Clark is a legendary figure in the field of coastal management. His career in coastal zone management (CZM) spans nearly five decades during which he has pioneered many of the CZM concepts and practices which are now gaining increasing attention globally and in Indonesia. He is especially familiar with the Indonesian context for coastal management through his work (since 1992) on the Bali Beach Conservation project; work which is continuing at the present time.

He has authored some 26 books, and been a major contributor to numerous other publications including the recently published "Ecology of the Indonesian Seas" also reviewed in this journal. His works have become seminal reference sources for generations of coastal zone managers, particularly because his writings have a reputation for clarity, organisation and comprehensiveness.

This most recent publication is no exception. Clearly defined as a reference book in the classic sense, it is organised into four main parts: (1) concepts, problems and approaches to coastal zone management which form a 'blueprint' for integrated coastal management programs, (2) some 46 specific management approaches to deal with a very wide range of coastal management issues, (3) a general compilation of information about coastal planning and management presented as 110 individual sections, and (4) some 47 case studies of global coastal management programs (including a case studies of projects in Bali, Java and Sulawesi) which feature contributions from various global experts in CZM.

The encyclopaedic nature of the work may daunt Indonesian readers (and many native English readers also), but has two 'saving graces'. Firstly, the work is a 'one-stop shop'; novice coastal managers need look no further for a single introductory reference text which will have at least something of relevance to their topic of interest. Secondly, the text is made more readable by both numerous figures and photographs and by the careful division of text into easy-to-find 'mini-bites'.

While one could quibble about the relevance of some sections of the work and there is some inevitable repetition of concepts, clearly this is a landmark book and one which shall long stand as a benchmark reference in the field of coastal management. Every university teaching CZM-related courses, every government agency beginning CZM programs and every research organisation supplying information to decision-makers on CZM issues in Indonesia should have a copy. For other potential audiences (such as students), you may care to wait for the summary version which John is currently preparing - it will be printed.

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RESENSI BUKU

John R. Clark (1996) Coastal Zone Management Handbook, Lewis/CRC Press, Boca Raton, Florida, 694pp. ISBN: 1-56670-092-2, RRP US$89.95

John Clark adalah seorang tokoh legendaris dalam bidang pengelolaan kawasan pesisir. Dalam pengalamannya selama hampir lima dasawarsa, ia memelopori banyak konsep dan praktek CZM yang semakin mendapat pengakuan secara global dan di Indonesia. Ia mengenal baik bidang pengelolaan pesisir dalam konteks Indonesia. Hal ini terutama dimungkinkan karena tugasnya dengan Bali Beach Conservation project sejak 1992 hingga saat ini. John Clark telah menulis 26 buku serta menjadi kontributor utama sejumlah penerbitan lainnya, termasuk Ecology of the Indonesian Seas yang baru saja muncul (dan dianalisa juga dalam jurnal ini). Karyanya merupakan sumber referensi penting bagi pengelola wilayah pesisir, karena tulisan-tulisannya itu mempunyai reputasi baik, karena jelas, teratur dan lengkap.

Karyanya yang terakhir ini juga termasuk kategori yang demikian. Digolongkan secara tepat sebagai buku referensi klasik, isinya terbagi dalam empat bagian utama yang mengandung: (1) konsep, masalah dan pendekatan terhadap manajemen zona pesisir yang menjadi satu pola dasar bagi program pengelolaan daerah pesisir yang terpadu, (2) daftar dari 46 pendekatan manajemen yang spesifik untuk menggarap serangkaian masalah-masalah pengelolaan daerah pesisir, (3) informasi umum mengenai perencanaan dan pengelolaan wilayah pesisir pantai yang dirangkum sebagai 110 bagian tersendiri, dan (4) sekitar 47 kasus studi mengenai program-program manajemen pesisir di seluruh dunia (termasuk studi sejumlah proyek-proyek di Bali, Jawa dan Sulawesi) yang menampilkan sumbangan karya tulis berbagai pakar global mengenai CZM.

Karena buku ini berbentuk ensiklopedia, hal itu mungkin agak menyulitkan sebagian pembaca, namun buku ini memiliki dua kekuatan utama. Pertama, karya ini bagaikan sebuah toko serba ada; pengelola pesisir yang masih awampun cukup memakai satu buku ini saja untuk menemukan referensi awal yang penting, lagipula buku ini mengandung bahan-bahan yang relevan dalam bidangnya. Kedua, naskahnya dibuat sangat efisien untuk dibaca dengan adanya cukup banyak grafik dan foto, serta naskahnya disusun secara teliti kedalam bab-bab kecil yang mudah ditemukan.

Meskipun beberapa pakar tertentu mungkin mempersoalkan relevansi sebagian dari buku ini, serta pengulangan kembali beberapa konsep (yang tak dapat dihindarkan), secara jelas buku penting ini akan berfungsi sebagai referensi dasar utama dibidang manajemen daerah pesisir, antara lain universitas yang hendak mengajarkan mata kuliah CZM dan seluk-beluknya, setiap instansi pemerintah yang mengawali program CZM-nya, dan setiap organisasi riset yang memasok informasi bagi para pembuat keputusan mengenal hal-hal CZM di Indonesia sebaiknya memiliki buku tersebut. Pembaca potensial lainnya (misalnya mahasiswa), dapat menunggu diterbitkannya edisi ringkas yang sedang disusun oleh John. Buku tersebut akan keluar tahun 1998.

Ian Dutton
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BOOK REVIEW

Tomas Tomascik, Annmarie Janice Mah, Anugerah Nontji and Mohammad Kasim Moosa (1997) The Ecology of the Indonesian Seas, Periplus Editions, Singapore, Part One: ISBN 962-593-078-7, 1-642 + xiv and Part Two: ISBN 962-593-163-5, 643-1388 + vi, RRP Rp170,000.

The long awaited 'wet' additions to the Ecology of Indonesia series, published under the EMDI (Environmental Management in Indonesia) program of CIDA (Canadian International Development Agency) in partnership with the Ministry of Environment of the Government of Indonesia, arrived in the bookstores of Jakarta in late 1997. That they have been well worth waiting for is clearly evidenced by the difficulty which many of us have experienced when we returned to those stores to obtain second or third copies as gifts during the recent festive season - "I'm sorry sir, but you will have to wait until new stocks arrive" is a frequent response of bookstore employees who are intrigued why anyone could possibly want to buy two books which look more like door stops than a good read !

As anyone who has endured the experience of trying to locate, compile or otherwise utilise information on the marine and coastal resources of Indonesia will appreciate, these books are much, much more than a good read. They are indispensable guides to the treasure house of Indonesia's marine estate. They are also one of the finest compilations of the state of knowledge of any subject I have ever had the privilege to read. The fact that both volumes are of direct and immediate relevance to the rapidly emerging national interest in coastal and marine resources management thus makes them an essential addition to the shelves of anyone in Indonesia who shares that interest.

The four distinguished authors and other expert contributors, under the leadership of Dr Tomascik have produced a book which, by virtue of the range of subject matter addressed and the detail provided on each subject, had to be divided into two parts, but are in reality, an indivisible whole. Part One begins with an introduction to the geology and oceanography of Indonesia's seas before moving on to a series of chapters on coral reefs and the environmental factors which sustain them. The emphasis of much of the book on coral reefs is appropriate in view of Indonesia's pre-eminent position as a global centre for marine biodiversity and their current parlous state due to ignorance, over-exploitation and lack of management attention. It is especially appropriate that such a comprehensive analysis of the world's most diverse and extensive reefs first appeared in the International Year of the Coral Reef (1997).

The second part of the book begins with further reviews of specific reef types (fringing, patch, barrier and cays) and then diversifies into reviews of seagrass, mangrove and pelagic systems. The book concludes with a cogent and timely analysis of threats to marine and coastal resources, integrated coastal zone management needs and possible approaches.

Throughout the book, numerous case studies (in short highlight boxes), beautifully drawn maps and diagrams and numerous photographs (including colour plates) help to break up the voluminous text. Finding material on specific subjects and locations is aided by a comprehensive index and the comprehensive bibliography (some 88 pages of references) provides a well-organised guide to additional information sources.

Despite the obvious efforts of the writers to express many of the more complex concepts as simply and clearly as possible, non native english speaking readers, and especially non scientists will find much of the text of this book 'hard going'. It is to be hoped that academicians, researchers and managers will collaborate to build on this work and to make its vast store of knowledge more readily available to decision-makers, resource users (including developers) and the Indonesian coastal communities whose lives depend on maintaining healthy seas. This work will then have achieved its truly remarkable potential.

Ian Dutton
CRC/URI
Proyek Pesisir
Jakarta

RESENSI BUKU

Tomas Tomascik, Annmarie Janice Mah, Anugerah Nontji dan Muhammad Kasim Moosa (1997). The Ecology of the Indonesia Seas, Periplus Editions, Singapore, Part One: ISBN 962-593-078-7, 1-642 + xiv and Part Two: ISBN 962-593-163-5, 643-1388 + vi, RRP Rp. 170.000.

"Bagian basah" yang telah lama ditunggu dari seri Ecology of Indonesia, diterbitkan oleh program Manajemen Lingkungan di Indonesia (EMDI) dibawah pengelolaan Canadian International Development Agency (CIDA) yang bekerjasama dengan kantor Menteri Negara Lingkungan Hidup dari Pemerintah R.I. Buku ini mulai muncul di toko-toko buku di Jakarta pada akhir 1997. Bahwa jilid-jilid tersebut cukup laris dan baik mutunya telah dibuktikan oleh pengalaman saya ketika kembali mengunjungi toko-toko yang sama untuk mendapatkan beberapa buah buku tambahan sebagai kado Hari Raya Natal baru-baru ini. Persediaan buku tersebut sering habis di toko buku.

Sebagaimana sering dialami oleh orang yang berusaha mencari, menyusun ataupun menggunakan informasi tentang sumber daya alam kelautan dan daerah pesisir di Indonesia, buku-buku tersebut jauh lebih berharga daripada tampak luarnya yang seakan-akan hanya hiasan rak buku saja. Jilid-jilid ini merupakan panduan penting yang tak dapat diabaikan mengenai khazanah alam kelautan Indonesia. Buku-buku tersebut juga adalah salah satu rangkuman terbaik mengenai sains yang telah terkumpul dari topik manapun yang sempat saya baca selama ini. Fakta bahwa kedua penerbitan itu secara langsung relevan terhadap perhatian nasional yang tertuang dalam bidang sumber daya kelautan dan pesisir akhir-akhir ini, menjadikannya esensial bagi kepustakaan orang siapapun di Indonesia yang mempunyai minat dibidang tersebut.

Keempat pengarang serta berbagai penyumbang lainnya, dibawah pimpinan langsung Dr. Tomascik, telah menghasilkan sebuah karya yang oleh karena luasnya bidang yang dicakup serta rincian mendetail setiap topiknya, terpaksa disusun menjadi dua buku terpisah, namun yang sebenarnya merupakan suatu kesatuan.

Bagian Pertama diawali oleh sebuah pendahuluan mengenai geografi dan oseanografi dari peranan laut di Indonesia, sebelum pembahasan tentang terumbu-terumbu karang serta faktor lingkungan. Perhatian terhadap terumbu karang di bagian buku ini sangat tepat mengingat kedudukan Indonesia sangat khusus yaitu sebagai pusat biodiversitas global kelautan dan keadaannya yang sekarang cukup kritis akibat kurang pengetahuan, eksploitasi berlebihan dan langkanya keterampilan manajemen. Sangat tidak tepat jika analisis lengkap mengenai terumbu-terumbu karang yang paling beraneka ragam dan luas ini muncul pada saat Tahun Internasional Terumbu Karang (1997) sedang berlangsung.

Bagian Kedua dari buku ini dimulai dengan analisis lanjutan dari tipe-tipe terumbu karang (fringing, patch, barrier serta cays) dan kemudian terbagi dalam beberapa tinjauan mengenai rumput laut, tumbuhan bakau dan sistim pelagis. Buku ini diakhiri dengan sebuah analisis yang cukup meyakinkan serta tepat waktu akan ancaman-ancaman terhadap sumber daya alam laut dan pesisir, kebutuhan-kebutuhan manajemen zona pesisir yang terpadu, dan tindakan-tindakan yang mungkin dapat dilaksanakan manusia.

Secara keseluruhan, banyaknya kasus studi (dalam kotak-kotak skema yang diarsir), peta dan diagram yang indah serta foto-foto dalam jumlah yang banyak (termasuk foto berwarna) membantu meringankan sifat monoton teks tebal itu. Jika kita hendak mencari bahan mengenai topik dan lokasi tertentu, tersedia indeks yang komprehensif serta sebuah bibliografinya yang lengkap (kira-kira 88 halaman referensi) sebagai panduan.

Kendati para penulis dengan lugas berusaha mengutarakan konsep-konsep yang kompleks secara jelas dan ringkas, pembaca yang tidak berbahasa Inggris, khususnya mereka di bidang non-akademis akan mendapatkan buku ini sukar untuk dimengerti. Para sarjana, ahli riset dan manajer akan bekerjasama sangat diharapkan dapat mengembangkan isi dari buku ini dan menjadikan buku ini sebagai gudang informasi bagi para pembuat keputusan, pemakai sumber alam (termasuk pengembang) dan masyarakat pantai Indonesia yang penghidupannya tergantung dari adanya lingkungan laut yang sehat. Selamat membaca. Saya kira buku-buku tersebut sangat mengesankan isinya.

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Publication

Assessment and monitoring of climatic change impacts on mangrove ecosystem. 1994. UNEP Regional Seas Reports and Studies no. 154.

Mangrove Ecology Workshop Manual. C. Feller (ed.). Smithsonian Environmantal Research Center.

Mangrove Forest Management Guidelines. 1993. FAO, Rome.

The Mangrove of Zanzibar. 1996. J.P. Shanula and A. Whittick. Institute of Marine Sciences, USDM. 65 pages. Describe flora, ecosystem, uses for the non-specialist. ISBN 0-88901-308.

Tropical Mangrove Ecosystems. 1992. D. Alongi and Robertson (eds.). 336 pages. Avalaible from the American Geophysical Union, the book is founded on the work done on Hinchinbrook Island and elsewhere in the tropics of Notheastern Australia. Contact: AGU-Orders, 2000 Florida Avenue NW, USA. Tel: 1-800-966-2481 (North America) or 1-202-462-6900 (elsewhere). FAX: 1-202-328-0566. E-mail: service@kosmos.agu.org. WebSite: http://earth.agu.org/pubs/.List-$37.00;AGU member-$25.90.

Available from ISME:

Conservation and Sustanaible Utilisation of Mangrove Forests in the Latin America and Africa Regions. **Part 1. Latin America**. 1993. L.C. Lacerda. (ed.). Mangrove Ecosystems Technical Reports, Vol. 2, ISME/ITTO. 272 pages. Out of print.

For ISME titles contact: ISME, c/o College of Agriculture, University of the Ryukyus, Nishihara, Okinawa 903-01, Japan. FAX: (81) 98-895-6602

Available from the IUCN:

Ecology and Management of Mangroves. 1993. Aksornkoae, IUCN, Bangkok, Thailand. 176 pages.

Mangroves of the Sundarbans. 1994. Vol. 1 India. A>B> Chaudhuri and A. Choudhury, IUCN, Bangkok, Thailand.

Manuel de Formation a la Gestion des Zones Humides Tropicales. 1994. J. Skinner, N. Beaumond and J.Y. Pirot. 272 pages. This book is a training manual for wetlands managers, based on West African Experiences. IUCN Publications. Uk pounds 13.50;US$20.00

For IUCN titles contact: IUCN Publication Services Unit, 219c Huntingdon Road, Cambridge CB3 ODL, United Kingdom. Tel. 44 1223 277894. FAX. 44 1223 277175. E-Mail: iucn-psu@wcmc.org.uk.

Periodicals

Indonesian Journal of Fishery and Aquatic Sciences. Contact: Dr. Dietriech G. Bengen, Department of Living Aquatic Resources Management, Faculty of Fisheries, Bogor Agricultural University. Tel: 62-251-622938. Email: dieter@indo.net.id

Indonesian Journal of Coastal and Marine Resources Management. Contact: Dr. Dietriech G. Bengen, Marine Center Building 4th Floor, Center for Coastal and Marine Resources Studies, Faculty of Fisheries, Kampus IPB Darmaga, Bogor Agricultural University. PO BOX 258 Tel: 62-251-626380. Fax: 62-251-621086 Email: awan-uri@indo.net.id

Mangroves and Salt Marshes. A new international journal concerned with the interdisciplinary science and management of tidal wetlands; it will cover pure and applied sciences and include studies on siltation, fisheries, forestry, aquaculture and the sustanaible use of mangroves and salt-marshes. Contact: Daniel Childers, Associate Editor, Southeast Environmental Reseach Program, OE 148 University Park, Miami, Florida 33199. Tel. (1) 305-348-3095; FAX (1) 305-348-4096

Conference

April 6-9. **International Conference on the Biology of Coastal Environments**. Bahrain. Contact: Dr. Jameel Abbas, Dept. of Biology, College of Science, University of Bahrain. E-mail: icbce97@internic.uob.bh. One of the main themes is mangroves.

May 5-7. **Annual Meeting, Pasific Northwest Chapter Society of Weland Scientists**. Corvallis, Oregon. Contact: Emily Roth, NRCS, Portland, Oregon. Tel: 503-235-6272.

May 15-16. **24th Annual Conference on Ecosystems Restoration and Creation**. Tampa, Florida. Contact: Frederick J. Webb, Dean of Environmental Programs, Hillsborough Community College, Plant City Campus, 1206 N. Park Rd., Plant City, FL 33566 USA. Tel: 813-757-2104. E-mail:webb@mail.hcc.cc.fl.us.

May 21-23. **1st International Conference on Sustanaible Tourism in Vietnam**. Hue, Vietnam. Russell Arthur Smith, Coordinator, Vietnam Tourism Development Program, Hanns Seidel Foundation & Nanyang Technological University. Tel: +65 799 4836. FAX: +65 791 3697. E-mail:arasmith@ntu.edu.sg.Web Site:http://edge.tamu.edu/waves97/.

June 2-6. **Coastline '97: Connecting European and Mediterranean Coasts.** 6th EUCC International Conference. Naples, Italy. Contact: Dr Giovanni Randazzo, Instituto di Scienze della Terra, Universitè di Messina, Salita Sperone, 31-C.P.24, 98166 – S. Agata di Messina, Italy. Tel. +39 90 6765095. FAX: +39 90 392333. E-mail: randazzo@labcart.unime.it.

July 7-9. **Air-Sea-Land Interaction Processes in Estuaries**. Melbourne, Australia. Contact: M. Cintia Piccolo and Gerardo M. E. Perillo, Instituto Argentino de Oceanografia, Av. Alem 53, 8000 Bahia Balanca, Argentina. Tel. (54-91) 23555/20254/558431. FAX (54-91) 88-3933/20254.

August 5-8. **U.S.-China Conference on the Environment**. Beijing. Contact: Global Interactions Inc., 14 West Cheryl Drive, Phoenix, AZ 85021-2481. Tel:602-943-3922. FAX: 602-943-4458. E-mail: global@goodnet.com. Web Site: http://www.goodnet.com/ global

Guidelines to Authors

Manuscripts format. Manuscripts should contain a cover page that includes the title, the name(s) of the author(s) and their addres(es). Each research paper, note and review article should have an abstract of not more than 300 words. For manuscripts written in Bahasa Indonesia, it must have an abstract in both Bahasa Indonesia and English. The abstract should state concisely the purpose of the paper, procedures followed, significant findings and major conclusions. Research papers must submitted according to the following format: *Introduction, Material and Methods, Results, Discussion, References and Appendix* (if required). Research notes should combine *Results and Discussion* sections, whilst all other forms of manuscript should list references at the end of the text.
Manuscript should be typed in Word Perfect (ver. 5.1 or later version) or Microsoft Word (ver. 5.0 or later version), used Times New Roman font type size 12, double-spaced, with margins 2.5 cm on A4 size paper. The right margin should not be justified and words to be printed in Italics should be underlined. Metric measurements should always be given, or where in appropriates the metric equivalents given in parentheses. All pages including tables should be numbered. Footnotes should be avoided and bound manuscripts will not be accepted.

Citations and References. Within the text, citation should be cited by author(s) and date in parenthesis as follows: (Bengen and Widinugraheni, 1995; Dartnall and Jones, 1986; Kenchington, 1978). For references cited with three or more authors "et al." should always be used.

Unpublished studies may be referred to as personal communications giving the name and short address e.g. (Darmawan, PKSPL- PB, and personal communication). It is the author's responsibility to obtain permission from the colleague whose work is cited in this way.

References should be listed in alphabetical order. The names of all authors and the full title of the paper must be supplied together with the years, volume and first and last pages.

If publication is in press, the reference should be cited as completely as possible and then by including (in press).

Examples of acceptable referencing format to the journal are provided below:

Bengen, D. G. and P. Widinugraheni, 1995. Sebaran Spasial Karang dan Asosiasinya dengan Karakteristik Habitat di Pantai Blebu dan Pulau Sekepal, Lampung Selatan. Prosiding Seminar Nasional Pengelolaan Terumbu Karang Jakarta, 10 - 12 Oktober 1995 : 81 - 95.

Dartnall, A.J. and M. Jones (eds) 1986. A Manual Survey Methods, Living Resources in Coastal Areas. Australia Institute Marine Science, Townsville.

Kenchington, R. A. 1978. Visual Survey of Large Areas of Coral Reefs. *In* D. R. Stoddart and R. E. Johannes (eds). Coral Reefs: Research Methods. UNESCO, Paris.

Tables. Tables are to be compiled on separate sheets. Tables are numbered consecutively. A title should be provided for each table and they should be referred to in the text.

Illustrations. Graphs, photographs, maps, etc will be designed as figures. All illustrations should similarly be numbered consecutively and referred to in the text. Each should be identified by the fig number, author, and abriviated title on the back. Poor contrast graphics will not be accepted Photographs should be in glossy print. The size of the lettering being appropriate to that of the illustration size, but taking into account the possible need for re-duction in size (up to 50 %).

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Petunjuk Penulisan

Format Naskah. Naskah harus memiliki halaman depan yang memuat judul naskah, nama dan alamat penulis. Setiap naskah harus memiliki abstrak dengan jumlah maksimal 300 kata. Untuk naskah dalam bahasa Indonesia, abstrak dibuat dalam bahasa Indonesia dan bahasa Inggris. Abstrak secara ringkas mensarikan maksud dan tujuan penelitian, prosedur pelaksanaannya, hasil-hasil dan kesimpulan utamanya. Naskah hasil penelitian disampaikan dalam format berikut: **Pendahuluan, Bahan dan Metodologi, Hasil, Pembahasan, Daftar Pustaka** dan **Lampiran**. Untuk naskah laporan singkat, **Hasil dan Pembahasan** digabungkan. Untuk seluruh jenis naskah harus mencantumkan **Daftar Pustaka** pada akhir tulisan.

Naskah ditulis dalam program-program pengolah kata seperti Word Perfect versi 5.1, Microsof Word versi 5.0 atau versi terbaru lainnya, menggunakan huruf Times New Roman ukuran 12, menggunakan 2 spasi dengan lebar margin 2.5 cm pada kertas ukuran A4. Margin teks tidak harus rata kanan, dan kata-kata yang dicetak miring hendaknya digaris bawahi. Hasil pengukuran disajikan dengan satuan metrik, atau diberi keterangan nilai ekuivalennya dalam kurung. Semua halaman termasuk tabel harus bernomor. Catatan kaki sebaiknya tidak digunakan and naskah tidak boleh dijilid.

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Jika tulisan yang dirujuk masih dalam proses akan diterbitkan, hendaknya dituliskan “(in press)”.

Untuk lebih jelasnya, berikut adalah penulisan daftar pustaka:

Bengen, D. G. and P. Widinugraheni, 1995. Sebaran Spasial Karang dan Asosiasinya dengan Karakteristik Habitat di Pantai Blebu dan Pulau Sekepal, Lampung Selatan. Prosiding Seminar Nasional Pengelolaan Terumbu Karang Jakarta, 10 - 12 Oktober 1995 : 81 - 95.

Dartnall, A.J. and M. Jones (eds) 1986. A Manual Survey Methods, Living Resources in Coastal Areas. Australia Institute Marine Science, Townsville.

Kenchington, R. A. 1978. Visual Survey of Large Areas of Coral Reefs. *In* D. R. Stoddart and R. E. Johannes (eds). Coral Reefs: Research Methods. UNESCO, Paris.

Tabel. Setiap tabel harus diketik pada halaman terpisah Penomoran tabel dilakukan secara berurutan Setiap tabel harus diberi judul. Penomoran harus didentifikasi dalam teks (*Tabel**).

Gambar. Grafik, Foto, peta dan sebagainya dikategorikan sebagai gambar. Semua gambar dinomori dan di-sesuaikan dengan teks naskah. Penomoran gambar dila-kukan secara berurutan dan harus diidentifikasi dalam teks (*Gambar**). Berilah keterangan untuk setiap gambar di halaman belakangnya dengan mencantumkan nomor gam-bar, nama penulis dan judul gambar. Grafik yang kurang jelas tidak akan diterima. .Foto dicetak pada kertas yang mengkilap. Ukuran kertas ha-rus sesuai dengan ukuran gambar tetapi sedapat mungkin sudah mempertimbangkan pengecilan ukuran hingga 50%.

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