

Chile Litoral

DIÁLOGO CIENTÍFICO SOBRE LOS ECOSISTEMAS COSTEROS

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Editores

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ÍNDICE

Presentación <i>Francisco Rojas Aravena y Rodrigo Araya Dujisin</i>	15
Introduction Governance, Science and Regional Economic Development in Chile's Coastal Zone Ecosystems <i>Ronald G. Hellman</i>	19
PRIMERA PARTE PERSPECTIVAS PARA OBSERVAR EL BORDE COSTERO	
Comprehensive Chilean Coastal Assessment: Challenges, Policy and Science <i>Ronald G. Hellman and Osman Morales</i>	31
SEGUNDA PARTE LOS CASOS REGIONALES	
Environmental Considerations and Conflicts Derived from the Development of Investment Projects on the Coastal Border in Southern Chile <i>Fernando Jara Senn</i>	101
El desarrollo portuario y su relación con la ciudad <i>Gabriel Aldoney</i>	111
El caso del Complejo Portuario Mejillones <i>Jorge Taboada Rodríguez</i>	141

TERCERA PARTE
CIENCIA Y POLÍTICAS PÚBLICAS

Monitores ambientales para evaluar efectos de actividades productivas en el borde costero y mares interiores de las regiones X y XI: el caso de la salmonicultura <i>Doris Soto Benavides y Fernando Norambuena Filcun</i>	165
Estuarine Management Related to Human Needs: Meeting the Challenge <i>Robert Nuzzi</i>	187
Examining Chile's Tenth Region and the tri-State Estuary as Models for Understanding Issues in the Management of World Fisheries <i>Martin P. Schreibman, Joseph W. Rachlin, Barbara E. Warkentine</i>	205
Generación participativa de una estrategia nacional y plan de acción para la conservación y uso sustentable de la diversidad biológica en Chile <i>Sandra Miettke</i>	217
Estrategias de biodiversidad. El caso de México: experiencias y consideraciones <i>Patricia Muñoz-Sevilla y Diana Escobedo-Urías</i>	243
Integrated Marine and Coastal Zone Management <i>Oscar Arizpe</i>	261
Integration of Socio-Economic Information with Physical data in the Coastal Zone Using Geographic Information Systems <i>Jeffrey P. Osleeb</i>	277
Sistema Integrado de Administración del Borde Costero (SIABC) <i>Cap. Carlos de La Maza</i>	295

CUARTA PARTE
CONFLICTOS Y RECURSOS NATURALES

Entre "Propiedad ambiental" y nueva acción social. Contribuciones al mejoramiento del manejo de los conflictos sobre recursos naturales <i>Ingo Gentes</i>	309
La Industria del Salmón: un caso de desarrollo exportador con base regional <i>Oscar Muñoz Gomá</i>	353
Education-Learning for the Natural History of the Coastal Region of Chile <i>Janis Roze</i>	399

Integrated Marine and Coastal Zone Management

OSCAR ARIZPE¹

ABSTRACT

The interface between land and sea, the coastal ecosystem, it is of vital relevance to the terrestrial and marine life forms-including humankind, and an important geologic, ecological, and biological domain. The coastline, contains some of the most productive and valuable habitats of the biosphere. It is also a place of natural dynamism where huge amounts of natural energy are released and a great abundance of life is nurtured, and it is a place of high priority interest to people because it contains dense populations. The coast undergoes great environmental modification and deterioration through landfill, dredging, and pollution caused by urban, industrial, and agricultural development, because the coastal ecosystem are precisely balanced, fragile areas susceptible to a variety of threats, including those posed by human interference in the natural system.

Many countries of the world are working out with special focus on integrated coastal zone management (ICZM) approach, and some have already begun to adopt such programs. The term integrated coastal management implies a conscious management process that acknowledges the interrelationships among most land-coastal and ocean uses and the environments that potentially affect. ICZM establishes a process whereby the government agencies intervention can be organized, informed, and effective through programs that are integrated with the various economic sectors and resource conservation programs. Within the huge human impact and threats in the coastal zone and the need to generate sustainable development strategies to solve the difficult

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situation of the coastal and marine systems in our planet, its important to develop and implement ICZM programs. Nowadays is considered as an excellent approach for biodiversity preservation, for protection against natural hazards, pollution control, enhancement of welfare, and as an excellent tool which provide the basis for sustainable use of the systems in the coastal environment.

1. INTRODUCTION

The interface between land and sea, the coastal ecosystem, it is of vital relevance to the terrestrial and marine life forms-including humankind, and an important geologic, ecological, and biological domain. The coastal area, or coastal zone, is defined as the transitional zone, specifically "that part of the land affected by its proximity to the sea and that part of the ocean affected by its proximity to the land. An area in which processes depending on the interaction between land and sea are most intense" (Clark, 2000).

The border between land and sea is not fixed, it changes daily with the tides, with the moon stages, seasonally with astronomic forces, and sporadically with seastorms and great river floods. Management or planning boundaries represent another way of delimiting the coastal zone and may or may not correspond very closely with our physical boundaries of the coastal zone. State coastal zone management programs, for instance, have adopted different types of boundaries for a variety of practical and political reasons.

1.1. COASTAL ECOSYSTEMS

Coastlines around the world exhibit a diversity of physical types and characteristics, the result of major differences in geology and natural processes. Even within the United States, major differences exist. The Atlantic coast, for instance, is characterized by a system of barrier beaches and a relatively wide continental shelf. The Pacific coast, on the other hand, is characterized by a narrow continental shelf, limited barrier beaches, a mountainous coastal region, and tectonically active geological system (Beatley, et al. 2002). These authors also describe that there are a many different habitat or ecosystem types within the coastal zone as we have defined it, each suggesting unique management and planning requirements. The introductory discussion here is oriented

toward several of the more important of these habitat/ecosystem types, including beaches and barrier islands, estuaries and coastal marshes and coral reefs.

Beaches and Barrier Islands: Beaches and barrier island systems serve many important social and natural functions. They are the first line of defense against hurricanes and coastal storms, they provide necessary enclosures for estuaries and marshes, they are home to a variety of plant and animal life (including a number of endangered species), and they provide considerable recreational and aesthetic benefits.

Estuaries: Represent some of the most ecologically productive elements of the coastal environment, rivaling tropical rainforests in their primary productivity. Estuaries are those coastal aquatic systems formed through the mixing of freshwater from riverine systems and saltwater from the ocean. Estuarine systems exhibit a complex food chain. Estuarine plants serve as direct food for certain animals (fish and shellfish), but more importantly provide small particles of decay (detritus), which are consumed by microscopic life (zooplankton), which in turn are consumed by fish and then by other animals higher on the tropic scale, including humans.

Coral Reefs: They represent one of the earth's most ecologically productive habitats. Globally, coral reefs comprise about 600,000 square miles and support at least a half a million species of life. The net productivity of coral systems is actually higher than many tropical forests. Global climate change, and the resultant sea level rise and rises in sea- water temperatures, could have a major damaging effect on the world coral reef systems. For instance, abnormally high water temperatures in the Caribbean is believed to be a major cause of recent bleaching episodes.

2. THE IMPORTANCE OF THE COASTAL ECOSYSTEMS

The interface of land and sea, the coastline, contains some of the most productive and valuable habitats of the biosphere. It is also a place of natural dynamism where huge amounts of natural energy are released and a great abundance of life is nurtured. It is a place of high priority interest to people, to commerce, to the military, and to a variety of industries. Because it contains dense populations, the coast undergoes great environmental modification and deterioration through landfill, dredging, and pollution caused by urban, industrial, and agricultural development (Clark, 1996).

The importance and value of the coastal zone cannot be underestimated. It is one of the most productive areas accessible to people. Fish and other seafood fulfill a significant portion of the dietary needs for millions of people around the world, while the industries of fisheries and aquaculture are commercial mainstays for thousands of coastal communities. The coast also provides an important safety feature for residents living near the ocean. Many types of coasts provide a barrier from natural hazards emanating from the turbulent seas. Beaches, dunes, cliffs, and barrier islands all, act as buffers against the high winds and waves associated with coastal storms.

The recreational issues of the coastal zone are another elements for which we value the region. Boating, fishing, swimming, walking, beach-combing, and sun-bathing are among the numerous leisure activities in which our society revels. Many of us go to the coast for the sheer beauty of it. The coastal zone also provides a unique habitat for thousands of plant and animal species. The coastal ecosystem is made up of myriad interconnected subsystems whose functions cannot be duplicated elsewhere. For instance, estuaries, with their unique mix of fresh- and saltwater, provide a nursery area for numerous species of fish. Likewise, coastal wetlands are home to a variety of birds, plants, and other biota, and also serve the important role of filtering impurities in the water coursing through them. These and other segments of the coastal ecosystem are precisely balanced, fragile areas susceptible to a variety of threats, including those posed by human interference in the natural system (Beatley, et al. 2002).

The land can strongly affect the sea. There are a lot of impacts on coastal ecosystems from terrestrial activity these include industrial and agricultural pollution; siltation from eroded uplands; filling to provide sites for industry, housing, recreation, airports, and farmland; dredging and improvement of harbors; and the excessive cutting of mangroves for fuel. The land impacts affect strongly the community security (from seastorms), tourism revenues, biological diversity, and natural resources abundance.

2.1. THE PRESSURES ON THE COASTAL ZONE

Natural Processes: Many pressures exerted on the coastal zone, some of these are part of the natural operation of coastal processes. Winds and waves move material and affect the landscape. More dramatic action occurs with coastal storms, including hurricanes and northeasters, which can bring high winds and wave surge forceful. Such alterations

in the landscape are part of the natural processes in motion in the coastal region. Coastal areas are dynamic, yet adaptable. Changes in the natural environment are to be expected, and the region can recuperate when allowed to continue its evolutionary process. It is when additional external pressures are exerted on the coastal zone that the area cannot recuperate fully. Human interference with natural processes can alter natural dynamics. For instance, hard structures built up along the beach to prevent erosion, can actually exacerbate the erosion problem by trapping sand in one area and preventing its natural lateral drift to areas downstream (Beatley et al. 2002).

Human Pressure: The effects of human-induced pressures on the coastal zone can be far-reaching and long-lasting. Both the marine and terrestrial environments are tightly integrated systems in which all the parts are interrelated and dependent on one another. Destruction or degradation of one component can lead to impairment of other parts or the dysfunction of the ecosystem as a whole. Areas which possess sensitive coastal resources (e.g., wetlands, water bodies, fish and wildlife habitats) are particularly vulnerable to cumulative impacts. Areas of the coast experiencing rapid population growth are also especially prone to cumulative impacts. Many of our current public policies can exacerbate the pressures placed on the coastal zone. Sewer systems and municipal wastewater treatment plants allow the density of coastal populations to increase dramatically. And the provision of public water supplies can deplete aquifer reservoirs at a faster rate than they can be replenished.

2.2. BIOLOGICAL DIVERSITY

Clark (1996 and 2000) and many other authors mention that biological diversity conservation is an urgent coastal matter. Thousands of species and subspecies of wild plants and animals are threatened with extinction. The most serious threat is habitat destruction. This destruction takes many forms: (a) the replacement of entire habitats by settlements, harbors, and other human constructions, by cropland, grazing land, plantations and by mines; (b) the effects of dams (blocking spawning migrations, drowning habitats, and altering chemical or thermal conditions); (c) drainage, channelization, and flood control; (d) pollution and solid waste disposal (from domestic, agricultural, industrial, and mining sources); (e) overuse of groundwater aquifers (for domestic, agricultural, and industrial purposes); (f) removal of materials

(such as vegetation, gravel, and stones) for timber, fuel, construction, etc.; (g) dredging and dumping; and (h) erosion and siltation (Salm & Clark, 1989).

2.3. SUSTAINABLE DEVELOPMENT ON THE COASTAL ECOSYSTEMS.

Human society is using resources and producing wastes at rates that are not sustainable. Nowadays sustainable development has become the relevant aspect in the human activities. There are many different definitions in current usage, no one of them accurately or fully embodying the two components "sustainable" and "development", and the relationship between these off-times dichotomous concepts. Sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development does not mean no growth. It *does* mean not wasting resources; but most proponents of sustainable development realize that without some growth, communities would not be in a position to provide for their citizens a decent standard of living and engage in the newly required effort to improve the environment. We must engage in efficient resource use, reversing the degradation of renewable resources and implementing strategies for the sustainable use of land, water, biological and genetic resources, and energy. Reducing waste generation, recycling wastes into productive activities, and finding safe ways of disposing wastes that remain are essential elements in creating a healthy and habitable world.

Most governments have some variety of environmental, resource management, and development control programs. These may include pollution control, natural hazards management, biodiversity maintenance, environmental assessment, wetlands protection, and so forth. But these programs are typically operated by a variety of agencies and are uncoordinated, with the result that each agency goes its own way, disregarding the others. Nor is there much coordination with various private sector enterprises or with the recognized non-government organizations (NGOs). This non-coordinated and non-integrated situation is inefficient at solving coastal zone problems.

3. COASTAL ECOSYSTEMS MANAGEMENT

For the reasons discussed at the previous paragraphs nowadays many countries of the world are working out with special integrated coastal zone management (ICZM) approach, and some have already begun to adopt such programs. The term integrated coastal management implies a conscious management process that acknowledges the interrelationships among most land-coastal and ocean uses and the environments that potentially affect (Cicin-Sain and Knecht, 1998). ICZM establishes a process whereby government intervention can be organized, informed, and effective through programs that are integrated with the various economic sectors and resource conservation programs.

The proposition that coastal ecosystems include both dryside (land) and wetside (water) components and that they should be managed together is considered fundamental. The planning boundaries for coastal zone planning and management are set to encompass dryside problem areas as well as wetside ones. The advantage of the ICZM (multiple use) approach over the traditional sectoral (single use) approach is that it provides a framework for broad participation and for resolution of conflicts between a variety economic development and resource conservation needs. The distinctive feature of an ICZM program is the fact that it is multi-sectoral and that it seeks to integrate or coordinate activities of existing users. Such efforts have significant political and managerial dimensions.

3.1. SOLUTIONS THROUGH MANAGEMENT

In no other part of the earth this integrated, multi-sectoral, resource planning and management approach is more needed than at the coastal ecosystems (Bosi and Cintron, 1990). The approach incorporates management of natural resources, conservation of biodiversity, maximization of socioeconomic benefits, and protection of life and property from natural hazards (such as cyclonic sea storms). Coastal areas and coastal resource systems are governmentally complex because of unclear jurisdiction, dispersal of authority, and the amount of common property resources involved. Therefore, resource management programs must involve all levels from national to village governments.

It is generally understood that there is no one "correct" way to organize, plan, and implement an ICZM program; the plan must be

tailored to fit into the institutional and organizational environments of the countries or regions involved, including political and administrative structures, economic conditions, cultural patterns, and social traditions. In one example, large-scale coral mining enterprises in southern Sri Lanka in the 1960s and 1970s left the shoreline exposed to erosion and storm surges, causing serious loss of beach and shoreland and exposure of the coast to storm surges. A local fishery collapsed; mangroves, lagoons, and coconut groves were lost to shore erosion; and local wells became contaminated with saltwater. Sri Lanka reacted by enacting an ICZM program in 1982, with first emphasis on controlling coral mining to protect the shoreline and a later emphasis on natural resources conservation. Even though the original problem was localized to part of the country and specific to one issue, a national ICZM format was set up as the best way to deal with it. This format proved to be ideal for broadening of the program to include the coastline as a whole and, later, to incorporate environmental issues (Clark, 2000).

3.2 THE INTEGRATED APPROACH

The ICZM approach can be expressed in a variety of forms of comprehensive, integrated coastal management, whether the focus is on management of privately owned shoreland or of the waters of the coastal "commons" (the areas held for use of all citizens). In purpose, ICZM programs are intended to address all resources in a defined coastal zone and to integrate the interests of a variety of economic sectors in conservation. ICZM -type programs, while distinctive in purpose, are rooted in such well-known and standard approaches as regional development planning, resource conservation and water-shed management.

In its *planning* mode, ICZM examines the consequences of various development actions and proposes necessary safeguards, constraints, and development alternatives that will guarantee sustainable development and the sustainable use of coastal natural resources, at the most productive levels possible.

In its *management* mode, ICZM assesses the environmental and socioeconomic impacts of specific development projects and recommends changes necessary to conserve resources and protect biodiversity. ICZM coordinates actions of various economic sectors to ensure that advances in one sector do not bring reverses in another.

The ICZM process allows great flexibility. It can concentrate on the hazards of coastal erosion, as in Sri Lanka's ICZM program; on fisheries, as in the emerging Philippines ICZM program; on coastal and marine protected areas, as in the proposed Saudi Arabia ICZM strategy; on shrimp aquaculture, as in Ecuador; on a "networking" approach (management dispersed among many agencies), as in Oman; or on land use, as in the United States ICZM program which has 30 separate state subprograms (Clark, 2000).

According to Kenchington and Crawford (1993), in a ICZM the following elements are required:

- A dynamic goal or vision of the desired condition of the oceanic or coastal area and the integration of human use and impact for a period significantly longer than conventional economic planning horizons, say 25 or 50 years.
- National objectives are broad, commonly agreed aims or common purpose to which policies and management are directed. For regional and local plans, progressively more detailed objectives consistent with the national objectives are usually required.
- Guiding principles for managers or statutory decision makers exercising discretionary powers for planning, granting approvals, or making changes to the purpose or extent of use and access.
- A strategy, commitment, and resources for the objectives to be met through detailed day-to-day management, which may involve several agencies and the community.
- Clear, legally based identification of authority, precedence, and accountability for achievement of the strategy in relation to any other legislation applying to the area in question.
- Performance indicators and monitoring to enable objective assessment of the extent to which goals and objectives have been met.
- Above all, political, administrative, and stakeholder will and commitment to implement the strategy.

4. MAJOR FUNCTIONS OF AN INTEGRATED ECOSYSTEM MANAGEMENT PROGRAM

The overall function of the ICZM -type program is to provide for the best long-term sustainable use of coastal natural resources and for perpetual maintenance of the most beneficial natural environment. In

practical terms, the ICZM program is intended to provide the basis for sustainable use of resources, biodiversity preservation, protection against natural hazards, pollution control, enhancement of welfare, development of a sustainable economy, and optimum multiple use.

Specific purposes may be identified as supporting fisheries, attracting tourists, improving public health, raising public awareness, or maintaining yields from mangrove forests. All of these require coordinated community action for their accomplishment, a need that ICZM fulfills.

4.1. DESIGNING AN ICZM PROGRAM

Every country evaluating the potential of an ICZM-type program will have its own special approach to conservation of resources and will be facing its own distinct array of coastal issues. The first priority has to be getting ICZM on the local and national political agenda and getting favorable action on a mandate for resource conservation. According with Clark (1996) while each country's program will be unique, there are several basic stages in the generation of an ICZM program that will be found to be common to all, in one form or another. These stages are as follows:

Policy Formulation: Creation of a policy framework to establish goals and to authorize and guide the ICZM program; accomplished by executive and/or legislative action.

Strategy Planning: Sometimes called *preliminary planning*, this is the stage where the potential impacts of the ICZM policy action are explored (on resources and resource users, on income and jobs, on social and cultural well-being), where benefits are evaluated, where a wide array of data is accumulated, and where a general strategy is created and recommendations are made for organization and administration of the ICZM program.

Program Development: Once the Strategy Plan is accepted by policy makers, development of the ICZM program can commence and a detailed Master Plan for its implementation can be created.

Implementation: Once the Master Plan is approved and a budget and staff are authorized, the Implementation Stage can commence.

In practice, the above stages are not so discrete and linear as theory suggests. Instead, there will be feedback and revisions of earlier stages as new facts and opportunities come to light in later stages. For example, there will certainly be the need for policy revision and strengthening

as a result of findings and recommendations from Stages 2 and 3. Therefore, the whole program must be flexible and adaptable.

4.2. STRATEGY PLANNING

Coastal planning refers to a process of comprehensively studying resources, economic activities, and societal needs, including problems and opportunities in the designated coastal planning area, or Coastal Ecosystem, and proposing future actions. The important purpose of planning is to examine the past and the present so as to choose the best outcome for the future. There are two important stages of ICZM *planning-strategy planning and master planning*. Strategy planning is the process that explores options and develops an *optimum strategy* for a management program. It examines the facts, considers the issues, suggests possible solutions, and proposes specific legal and institutional arrangements. Strategy planning is the key step in the process of organizing an integrated coastal zone management (ICZM) program because the whole strategy of the process is being worked out.

Strategy planning involves all the preliminary investigation, data collection, analysis, dialogue, negotiation, and draft writing that is necessary to enable those responsible to define problems, to identify options, and to proceed to authorize an ICZM program. The special characteristics of the coastal area require special planning and management approaches, such as those found in ICZM-type programs, approaches that anticipate and deal with unusual problems and the unique conflicts that arise along the coast. Those who work with ICZM programs will need special training. An example planning sequence (linearized) for an ICZM strategy might include any of the seven following steps:

- Investigation of issues and needs.
- Review of policies.
- Formulation of goals and objectives.
- Pre-planning review activities and preliminary strategy report (resources, legal/institutional, socioeconomic, plan boundaries, etc.)
- Organization of planning program (funding, staff, facilities, equipment, operational strategy).
- Implementation of master planning program (data collection, analysis, mapping, public hearings, etc.).

In the end, the Strategic Plan should recommend a Master Plan that includes review, analysis, and coordination functions leading to environmental assessment and issuing of special coastal development permits, a function that could be handled by an appropriate "lead agency" (see "Institutional Mechanism" below). It is accepted by ICZM experts that only a truly integrated program (i.e., one that includes all major economic sectors affected) can succeed fully. If important stakeholders are left out (e.g., tribal chiefs, port authorities, housing departments, tourist industries, fishermen, economic development planners) ICZM will probably fail. In fact, a major function of ICZM is to provide a framework for coordination of a wide array of interests.

4.3. OBJECTIVES

The goal of ICZM is to improve the quality of life of human communities who depend on coastal resources while maintaining the biological diversity and productivity of coastal ecosystems. Thus the ICZM process must integrate government with the community, science with management, and sectoral with public interest in preparing and implementing actions that combine investment and development with the conservation of environmental qualities and functions (GESAMP, 1996). ICZM program has as its central purpose the organization of an integrative, holistic system for ensuring sustainability of coastal resources, the perpetuation of biodiversity, socioeconomic improvement and security from natural hazards. These central purposes Clark (2000) propose that can be articulated as a set of typical ICZM objectives for the Strategy Plan, as shown in the example objectives listed below:

- Maintain a high quality coastal environment.
- Protect species diversity.
- Conserve critical habitats.
- Enhance critical ecological processes.
- Control pollution.
- Identify critical lands.
- Identify lands for development.
- Protect against natural hazards.
- Restore damaged ecosystems.
- Encourage participation.
- Provide planning guidance.
- Provide development guidance.

Much of the ecological and scenic disruption of the coast is from inadvertent side effects of coastal development. An effective program could provide specific guidelines and advisory services to development entities, enabling them to design and construct projects that avoid conflict with coastal conservation to the extent possible.

4.4. TOOLS

Many tools are available to ICZM planners and managers, most of which are familiar to planners and administrators. It is the mix of tools and their particular applications that are distinctive to ICZM. Some of the main tools are:

- Permits for building, land clearing, etc.
- Environmental assessment (EA).
- Natural area protection (marine reserves).
- Zoning, use allocation.
- Setbacks, buffer areas.
- Environmental standards and guidelines.
- infrastructure control.
- Land use regulations.
- Land use planning.
- Watershed management.
- Pollution regulations.
- Community participation.
- Conflict resolution.
- Rural assessment.
- Remote sensing and geographic information systems.

A major purpose of ICZM is to coordinate the initiatives of the various coastal economic sectors toward long-term optimal socioeconomic outcomes, including resolution of use conflicts and beneficial tradeoffs. This integrated, multiple-sector approach is designed to coordinate and jointly guide the activities of two or more economic sectors in planning and management. This supports a programmatic goal to optimize resource conservation, public use, and economic development. Integration is the *sine qua non* of ICZM.

As an example, fisheries may require port services similar to those that tourism depends on—an infrastructure system that supplies water, sanitation, transportation, and telecommunications. Therefore,

planning for both should be integrated with that for transportation and public works sectors.

Because the ICZM process operates at the interface between land and water, there is often intense conflict between private (or quasi-private) property-based operations in shorelands and public (common) property-based activities in the tidelands and coastal waters. Thus, the ICZM process may have an important mediating role between conflicting wetland and dryland interests. This essential role should not be played out competitively, sector against sector. Rather, the ICZM mediating/coordinating entity must look at all sectors with legitimate interests to find the most broadly compatible solutions.

The integrated approach of ICZM is particularly essential for effective multiple use approaches. The concept of greatest yield from the best multiple-use plan takes into view that specific resource systems are always components of a larger ecological system that contains many other resources with economic and social values. Also taken into account is the fact that component resource-systems naturally tend to be highly integrated and dependent upon one another. In summary, in no other part of the earth is integrated, multi-sectoral resource planning and management more needed than at the coast.

4.5. COORDINATION

Because coastal ecosystems are governmentally complex, they require an especially high level of intergovernmental coordination. Some of the causes are given below:

- The amount and complexity of public interests in coastal areas is high.
- The effects of conflicts and impacts of one sector on another that require government intervention is exceptionally high.
- There is considerable involvement with public (common property) resources and their conservation.
- Water is a fluid resource that is not containable or ownable in the usual sense and that simultaneously affects all coastal interests.
- A greater variety of coordinated multi-governmental policy decisions is required in coastal areas.
- There tends to be a high level of international interest in coastal matters.

4.6. JOINT MANAGEMENT OF LAND AND SEA

A key factor that distinguishes ICZM-type programs from others is that coastal waters and coastal lands are addressed *together in a single unified management program*. The special role of ICZM-type programs is that they are centrally organized and apply integrated, area-wide resources planning and management to the distinct landforms and waters of the coast. The coast is a place where special knowledge, techniques, and governmental interactions are involved. ICZM focuses on shoreline development, natural habitat protection, and environmental conservation.

ICZM addresses national concerns for the coastal waters and natural habitats (e.g., coral reefs and seagrass meadows), the adjacent shorelands, and the transitional areas such as woodlands and intertidal areas (beaches, mangrove forests, coral reefs, etc.) that lie between the permanent waters and the shorelands. It provides a method to resolve problems of interaction between coastal lands and coastal waters in much the same way as river basing planning provides a method for resolving problems of interaction of valley lands and river waters.

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