

INTEGRATED DEVELOPMENT AND MANAGEMENT OF THE RESOURCES OF THE COASTAL ZONE

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THE coastal zone comprises territorial waters (in the 200 m exclusive economic zone), adjacent shorelines, transitional littoral (intertidal) areas, salt marshes, beaches, estuaries, lagoons, backwaters and mangroves. This zone is a transitional area between land and sea where they interact with each other. Renewable resources of the coastal marine region are among the most valuable long range national resource. The multi uses of the coastal zone relate to recreation, tourism, agriculture, forestry, housing, industry, shipping, mining, commercial fishing and aquaculture. All these activities enter directly into the flow of national income and product. In addition, conservation, waste disposal and scientific research are also most relevant to the coastal zone though these directly do not flow into the national product. The productivity of the shallow seas is the greatest known rational utilization and conservation of coastal marine resources and justifies the highest priority to be given for planned development.

Since coastal zone is the most heavily populated area on earth, there is increasing evidence of decrease in marine productivity while, at the same time, coastal development and marine pollution are rapidly increasing. The desire for immediate short-range gain has led to severe depletion of coastal marine resources on a global scale.

The unique physical and biological characteristics of the coastal zone make it a focal point for socioeconomic growth and development, requiring inputs from pure, applied social and management sciences. Therefore a comprehensive assessment of the coastal zone ecosystem, together with its living and non-living resources, is an indispensable first step for its proper utilization and long-term conservation leading

to securing maximum public benefit from this most productive zone. Further, the coastal zone can be well comprehended only through coordinated and co-operative team efforts by scientists from different disciplines, not only to regulate the resources-use but also to develop environmental standards. Development and management of the coastal zone is a hybrid concept, combining elements of regional economics and environmental management, since it contains a good proportion of national capital, income and employment. Environmental management is particularly important in coastal areas, since estuaries and mangroves are among the biologically most productive areas on earth. As such, the management of the coastal zone requires that the nature and location of land and water uses be controlled, so as to ensure that its development is compatible with the objectives of the management programmes, namely to ensure the continuing productivity of the coastal ecosystems.

Coastal marine fishery is an economically important resource which provides high quality protein food for human consumption. Obviously, vast increases in total investments on crafts and gears, to increase fishing efforts, are evidently not the only way to continue growth in fishery or maintain the present levels of net yield. The conventional marine living resources are at present used most inefficiently, because of our (a) inability to make prediction based on scientific understanding of the dynamics of the marine population and ecosystems; (b) poorly defined management objectives and (c) administrative and procedural impediments in enforcing restraints and regulations on the primary inputs to fishing. The economic and ecological considerations must therefore lead to attempts to re-

formulate fishery management objectives as follows: (i) Survey, monitoring, analysis and assessment should precede planned use and accompany actual use of the resource and (ii) Minimizing the risk of irreversible changes or adverse effects of exploitation. Such an approach will help us to manage our coastal marine fishery on sound ecological principles.

Development of fish farming in coastal waters will definitely help to increase the production of living resources from the sea. It is predicted that at least half of the world fishery will be affected by aquaculture over the next three decades and that capture fisheries will become merely a phase of culture fisheries. Aquaculture has gained world-wide recognition today and underlines the need to adopt, on a large scale, methods of husbandry to meet the world's future requirements of many aquatic products. Its role in integrated rural development, generation of employment and earning valuable foreign exchange is being increasingly appreciated. Greater use of coastal waters for fish farming could provide an efficient means of recycling agricultural and domestic wastes and can thus help in waste disposal and environmental protection.

Of increasing current importance are minerals from the sea bed (inshore and offshore), of which oil and gas are by far the most important. The production of oil and gas from the sea bed has dramatically increased in recent years and may reach 50% of the world production within the next decade. A significant breakthrough in the mining of polymetallic nodules is also close at hand. Water is the greatest resource of the ocean and tapping the ocean for fresh water is of utmost necessity. It is expected that fresh water from sea may reach 4 million m³/day in the near future.

A major concern with the increasing use of coastal resources, not only for the present but also for posterity, relates to sea pollution. Sewage, oil-cargo residues, domestic, industrial, radioactive and toxic chemical wastes are being indiscriminately used and these naturally find their way through the estuaries, to form a cess-pool near the shore, into the sea. This calls for an urgent study on the physical, chemical and bio-

logical processes in which the pollutants take part. The introduction of chemicals which do not naturally occur in the coastal marine environment (like DDT and PCBs) and materials which do occur but are released in coastal water in unprecedented quantities (such as heavy metals and hydrocarbons) can have stress effects on natural coastal marine processes that may become irreversible. Hence baseline studies and monitoring of pesticides and hydrocarbons should be undertaken to measure seasonally the levels of these persistent compounds in edible sea food and other non-target marine organisms. Due to the potential toxicity to man of accumulated and concentrated heavy metals, monitoring of these elements in water, sediments and resident organisms from different habitats and trophic levels must also be undertaken. The overall aim of such monitoring is, to obtain a general assessment of the relative hazards of polluting chemicals and metals to marine biota, to develop water quality criteria and background information for future monitoring studies.

It is our responsibility, therefore, to ensure sound management of our coastal zone all along without environmental degradation. It must be our concern not only to conduct marine scientific investigations but also to apply the present knowledge—scientific, economic and technological—to coastal developmental problems. This is a most realistic approach since coastal zone management and development will be vital issues in the years to come, over which our government will have to define its policy and enact necessary laws. Such a policy should be based only on scientifically collected baseline data which calls for a close collaboration between scientists, industrialists and policy makers. Every attempt should be made to co-ordinate and integrate these research so as to secure maximal public benefit.

A basic understanding of the essential features of the coastal ecosystem will involve long-term studies, but every possible attempt should be made to co-ordinate the integrate such research and monitoring programmes through regional centres equipped with mechanisms for retrieval

and dispersion of information useful to each region. The time is now ripe to establish marine parks and reserves to promote research, planning, development and management programmes, related to them. Regional as well as national developmental programmes should be undertaken immediately to survey and map the characteristics of the ecosystem, biomes and special habitats, before any form of land and water use along the coastal zone is decided upon. As such, planning for marine parks and reserves should also be an integral part of the national and regional land use planning.

The coastal zone is divisible essentially into four zones.

(a) *Zones for preservation and study*—mangrove and reefs—where development is not great but can proceed in accordance with ecological guidelines and where restoration is also possible.

(b) *Zone for industrial development*: Areas which are already highly developed industrially and otherwise highly polluted, low in productivity and cause greater concern towards the health of coastal population.

(c) *Zone for fishery development*: Exclusive for commercial fishery operations.

(d) *Zone for recreation*: Water sport and sport fishing.

The marine parks and reserve will serve as guides for proper coastal development and have the following functions.

(a) To conserve and manage representative samples of highly productive coastal marine habitats and ecosystems.

(b) To protect endangered species and their habitats.

(c) To conserve and manage important breeding grounds for commercially valuable species.

(d) To serve as areas of tourism, recreation and education for the public.

(e) To serve for the education, research and training of scientists and conservationists.

(f) To preserve these areas in unaltered conditions for posterity.

(g) To monitor the environmental effects caused by human intervention in other areas by using this area as a standard.

We have a great need for trained personnel to undertake planning, management and development of our coastal areas including the marine parks.

With greater vision and enthusiasm and without financial constraints our country should take a bold step and play a leading role in organising a national programme for integrated coastal zone management and development with as many regional centres as possible. India has a coastline of nearly 6000 km and these coastal areas must be mapped on a uniform geographical reference system, considering basic characteristics like topography, geomorphology, hydrology, resources, reserves and location of industries. Similarly water quality assessment, pollution monitoring and environmental inventories must also be undertaken for all estuaries, mangroves and backwaters. The coastal zone must be directly related to preventing adverse impacts on this vital yet fragile but highly productive area. The coastal development projects in future should be evaluated, even at the feasibility stage, with regard to their social profitability in addition to environmental impact.

As coastal management is an integral part of national development planning, three major problems can be encountered here. The first relates to conflicts between different uses of the coastal zone. The second is the destruction or deleterious modification of valuable coastal areas like mangroves and salt marshes. The third relates to the pollution of coastal waters resulting in hazards to human health and fisheries. It is in the coastal area that critical problems stemming from marine pollution exist. The requirements for a national programme of coastal management can be grouped under three broad categories:

(a) an information base and a management information system;

(b) a legal and administrative framework for operating the programme.

(c) a planning and evaluation procedure for choosing the kinds of development and their location in the coastal areas.

In the present state of our knowledge about the ocean and the coastal environs, one point

emerges foremost, that is, by the year 2000 our demands for food, energy and minerals will be so enormous, that the coastal zone hereafter will be subjected to farming, mining and exploitation just like the land.

ANNOUNCEMENTS

USSR HONOUR TO PROF M. G. K. MENON

Prof. M. G. K. Menon has been elected foreign member of the USSR Academy of Sciences in recognition of his distinguished contributions to many fields of fundamental sciences, in particular, to cosmic ray studies and physics of the elementary particles.

An honorary diploma was presented to Prof. Menon by the Soviet Ambassador in India Mr. V. N. Rykov, at Delhi when Prof. Menon's contributions to modern physics and his outstanding role in the organisation and development of the Indian Sciences in general were high lighted.

ROYAL SOCIETY BURSARIES FOR SIX SCIENTISTS

Six Indian scientists have been awarded Commonwealth bursaries by the Royal Society. The scientists are: Dr Bir Bahadur, Department of Botany, Kakatiya University, Warangal, Dr Krishna B. Garg, Department of Physics, Univeristy of Rajasthan, Jaipur, Dr Sabir Singh Gosal, Tissue Culture Laboratory, Pubjab Agricultural University.

Dr (Mrs.) Vasantha Pattabhi, Department of Crystallography and Biophysics, Univeristy of Madras, Dr Narayan Chandra Rana, Radio Astronomy Group, Tata Institute of Fundamental Research, Bombay, and Dr Ram Sagar, Department of Physics, Kumaun University, Nainital. The Society was founded in 1660.

THIRD WORLD FOUNDATION FOR SOCIAL AND ECONOMIC STUDIES, LONDON

The Third World Prize Selection Committee invites nominations for the Third World Prize of US \$ 100,000, to be awarded in 1983.

The Prize will be conferred on individuals or institutions for outstanding contribution to Third World development, particularly in the economic, social, political and scientific fields. The principal considerations for the award of the prize are originality, inspiration, enterprise, creativity, inovation and service to the general good of the people of the Third World.

Nominations may be made in English, French or Spanish and should reach not later than 30 September

1983. The nominations should be fully supported by publications or other relevant material.

The Prize for 1982 was awarded to the International Rice Research Institute, Manila, Dr M. S. Swaminathan, Director General, International Rice Research Institute, Manila, delivered the Thrid World Lecture 1983 entitled "Agricultural Progress: Key to Third World Prosperity".

Further details may be had from: AZIM HUSAIN, Member-Secretary, Third World Foundation for Social and Economic Studies, New Zealand House, Haymarket, London SW 1Y 4TS, UK.