many coastal areas as a result of industrialisation and tourism. Today, about 60 per cent of humanity (or nearly three billion people) live in the coastal zone, and two-thirds of the world's cities with population of 2.5 million or more are near estuaries. Within the next 20-30 years, the population of this zone is expected to almost double.  

This population pressure is inevitably altering land use patterns in coastal zones thereby giving birth to multiple use conflicts. Other impacts come from pollution, flooding, land subsidence and compaction, and the effects of upland water diversion. Natural habitats are being lost through reclamation for urban and industrial development, agriculture and mariculture. Near-shore regions are being degraded by eutrophication and industrial waste; public health is threatened by sewage contamination of beaches and seafood; and the marine environment is being fouled by the progressive build-up of chlorinated hydrocarbons, plastic litter and the accumulation of tar on coastlines.

Some of the waste products of coastal development, augmented by discharges through coastal outfalls and rivers, spread outwards to the world oceans, carried out by the atmosphere, currents and ships. The visible fingerprint of humanity (oil slicks, plastic litter and other debris) can be found everywhere. Moreover, the oceans have also been affected by many 'invisible' changes in the current century. Most commercial stocks of fish are now over exploited and
the balance of whole ecosystem is at risk.³

There was considerable concern over the state of coasts and oceans at the times of the Stockholm Conference on human environment. Since then, action has been taken to stop the dumping of polluting wastes at sea, to eliminate damaging pollution from ships to limit discharges from land-based sources, and last but not least to make world community aware of the issue.⁴ Nevertheless, the pressures of coastal zone development are leading to continuing environmental degradation in many parts of the world and these conditions are likely to be exacerbated by climatic change and sea-level rise within the next 50 year or so.

Need for Integrated Coastal Zone Management:

Coastal zones are of great economic, social and environmental significance in most coastal nations. They are extremely attractive areas for human settlement and use due to their wealth of natural resources and amenities such as fisheries, productive wet-lands and beaches. Yet it is this very attraction that has led to intense pressures being placed on the diverse and valuable resources of the coastal zone, pressures which are likely to increase.

There is growing evidence that traditional sectoral approaches to the management of resources and activities in coastal areas are inadequate. Despite best efforts in many cases, natural coastal systems continue to degrade, resource
use conflicts are mounting and the social and economic benefits which could be derived from the natural resources of the coastal zone are being lost.  

Integrated coastal zone management (ICZM) is a dynamic process in which a co-ordinated strategy is developed and implemented for the allocation of environmental, socio-cultural and institutional resources to achieve the conservation and sustainable multiple use of the coastal zones. The ICZM has five attributives:  

1. It is a process that continues over considerable time and requires continual updating and amendments. It is not a one time project.  
2. It has a geographic boundary that defines a space which extends from the ocean environment across the transitional shore environments to a specified inland extent.  
3. There is a management arrangement to establish the policies and process for making allocation decisions.  
4. The management arrangement uses one or more strategies to rationalise and structure the allocation decisions.  
5. The management strategies selected are based on a systems perspective which recognises the associations between coastal resources and processes. The systems perspective usually requires that a multisectoral approach be used in the design and implementation of the management strategy.
It is clear that integrated coastal zone management involves a non-sectoral approach to the management of coastal resources. It must consider the environmental, natural resources, socio-economic, political, cultural and geographic dimensions of the coastal zone in a multi-sectoral framework.

In the coastal zone the economic and environmental systems are highly interdependent. Any new development that changes the economic system effects the environmental system and these changes have a 'feed back effect' on the economic activities and can be seen below:

Fig. 1: Relationship between Economic and Environmental System.

Where the change in environmental conditions is associated with one or more impacts then, directly or indirectly, the economic welfare and the pattern of economic-environmental circle is close. Fig. 2 illustrates how an initial change within the economic system, which is
triggered off by new development, leads to a set of responses within the environmental system which later reacts back upon other activities within the economic system. In turn, these may generate secondary responses in the environment which lead to further changes in the pattern of economic activities.\(^8\)

![Diagram](image)

**Fig. 2 : Change and Response in Economic and Environmental Conditions**

At present these cycles of change and response which link the two systems tend to be regulated on a piece-meal, unco-ordinated basis with the result that the condition of coastal zones is too often unsatisfactory both from the environmental and the economic point of view. Hence, there is need to integrate the planning and management of economic development and of environmental protection in such areas.
Delineating Coastal Zone:

Located between the open ocean and the terrestrial domain lies a loosely defined area referred to as the coastal zone. Neither purely land or sea, it is an area of intense physical, ecological and social interaction. It has been generally defined as that part of the land affected by its proximity to the ocean. It is an area in which processes depending on the interaction between land and sea are most intense.

The United States recognising that coastal areas are the focal point of a wide range of impacts from both territorial and marine activities enacted legislation in 1972 for the planning and management of coastal zones. The US coastal zone management Act 1972 is about the earliest legislation developed with respect to coastal zones management. Focusing on comprehensive resource management, it defines the coastal zone as the 'coastal waters (including the lands therein and thereunder) and the adjacent shorelands (including the waters therein and thereunder) strongly influenced by each other'. The seaward limit is the outer boundary of the USA territorial sea. The landward limit is discretionary.

In practice, the zone may include a narrowly defined area about the land-sea interface on the order of hundreds of meters to few kilometers, or extend from the inland beaches of coastal watersheds to the limits of national
jurisdiction in the offshore. Its definition will depend on the particular set of issues and geographical factors which are most relevant to each stretch of coast. In India, the Ministry of Environment and Forests notification on coastal regulation zone (1991) has drawn an arbitrary boundary of 500 meters from the high tide line landward. However, for comprehensives planning and management purposes the zone may be much wider.10

Furthermore, the identification of space over which coastal policy applies requires a great deal of judgement and commonsense. The basic parameters for such a decision is set by the final intention of coastal management and the particular institutional context in each country.

LITERATURE SURVEY:

Although extensive research is progressing on environmental science, engineering and management aspect of oceans and coasts the study on integrated coastal zone management is limited to the study of environmental status only. Historically, the concentration of efforts has been on the scientific and technological aspect of coastal zone management. However, few literatures are available on the legal aspect of ocean and coasts management. Hence, the comprehensive planning and management studies on coastal environments is limited.
However, Brahtz, J.F.R (1972) has brought out an edited volume on "Coastal Zone Management: Multiple Use with Conservation". This volume has the specialised matters on conservation of biological and mineral resources, the needs of systems planning to control coastal zone development, marine waste disposal and marine transport system. These studies are framed for the policy derivation in general and status assessment in particular. Each physical character has been assumed as either extractive or non-extractive and appropriate primary resources for this activity has been identified for the multiple use of coastal environment. The Major conflicts involved in the use of marine and coastal resources and anticipated technology measures are discussed with reference to proper policy guidelines and decision making.

Ketchum, B.H. (1972) in this volume has clearly outlined the why and how of the coastal zone management. He has identified the critical problem of the US coastal zone. Coastal zone management is a process designed to achieve set or stated objectives. The stated objectives would be to maintain and to improve coastal zone's usefulness for man by ensuring the quality and extent of the natural system upon which he depends. It puts forward some guidelines for policy and decision makers.

Clark, J.R. (1977) has emphasized the increasing concern for ecology and conservation of resources in the
coastal ecosystem. He has discussed in detail many techniques that have been developed to analyse and evaluate environmental impacts of different kind.

Barnes, R.S.K. (1977)\textsuperscript{14} in his book discusses the ecological values of coastal ecosystems. The coastal ecosystems (salt marshes, dunes, beaches, wetlands, coastal waters etc.) plays extremely important role for human society. Coastal development has led to destruction of estuaries, beaches etc. He warns that areas of scientific and recreational value, with many important flora and fauna will be lost if proper coastal management is not practiced.

Honikawa, K. (1978)\textsuperscript{15} has approached planning and management issue in the coastal zone from the standpoints of either controlling or avoiding unwanted impacts of physical coastal processes on assets and communities by engineering solutions and installations.

EKISTICS, (March/April 1982)\textsuperscript{16} in this issue deals with various aspects of the problem of coastal areas, management perspectives and attempts to describe some positive national and international efforts to cope with the coastal area management. It advocates the role of ecological mapping and environmental impact assessment in coastal planning and management. The EIS is a valuable tool to encourage 'productive and enjoyable harmony between man and his environment'.
Sharma, R.C. (1985)\textsuperscript{17} in this volume has edited papers which place pertinent focus on the various aspects of the marine environment surrounding India. It deals primarily with the scientific aspects of living and non living resources, the question and problems of their development, the issues confronting India in the context of the emerging international oceanic regime and perspectives on the maritime security aspects of India.

Nair, N.B. (1987)\textsuperscript{18} has edited articles in this volume which focuses on all aspects of scientific management of Indian estuaries. They mainly deal engineering, physical geological processes, and human influences both as process and response. They are mainly status papers.

Tolley, M.J. and Ian Sherew (1987)\textsuperscript{19} have analysed the implication of global warming and sea level rise on the coastal assets, communities and coastal ecological balances. For the next century, they caution the policy makers and planners about sea level rise and suggest integration of this phenomena in the planning and management process of the coastal zone.

Dwivedi, S.N. and et.al. (1989)\textsuperscript{20} in this volume have edited articles on various aspects of coastal use and related problems in India. It is an outcome of a National seminar on ‘Coastal Planning and Management : Sea Level Rise’ in 1989.
It also recommends plan of actions to policy makers and planners to treat coastal zone as a sensitive area that needs special protection from over exploitation and destruction due to pollution.

Gable, F.J. and D.G. Aubrey (1990)\textsuperscript{21} have analysed the threat of man-induced global change on the South Asian countries and seas. They have pointed out that it varies from place to place because of differences in exposure to monsoons and storms, differences in local tectonics and subsidence, and variations in air and sea climates.

R. Sengupta et. al. (1990)\textsuperscript{22} in this report analysed the state of marine environment in the South Asia seas region. In all the countries of the region, the state of marine environment is far from satisfactory. Common problems of immediate concern for all the countries include petroleum hydrocarbons, microbial pollution, sewage and industrial wastes disposal with associated heavy metal, agricultural wastes including pesticides residues, siltation changes associated with changes in soil erosion and possibly hydrological cycles.

B.U. Nayak et.al. (1992)\textsuperscript{23} in this article gives an over-view of Indian Coastal zone and seeks to establish one Central Coastal Zone Management authority for co-ordinating and implementing coastal zone management in India. Most recent advances in ocean science and technology are to be used to resolve any conflict that may arise in the
interactive uses of the coastal zone and implementation of public goals. He also puts forward some engineering and management techniques to be applied in the coastal zone management.

Wells P.G. and J.M. Bewers (1992)\textsuperscript{24} have in this special volume edited articles focussing on issues and directions of coastal and marine environment protection, advances in the field of integrated coastal zone management and challenges ahead. The application of remote sensing and geographic information system are notably emphasized in coastal management.

Singh, Chhatrapati (1992)\textsuperscript{25} constitutes an exploration of 'water rights' and 'water laws' in India. Most assays in this volume direct attention to legal complexity which inevitably escalates asymmetry of power relations in society. The paper by Iqbal Siddiqui is a chronological survey of the history of legislative activity in the area of water law in India.

Sharma, O.P. (1993)\textsuperscript{26} in his article discusses the legislation enacted, institutional arrangements devised, the scheme of enforcement envisaged and how various difficulties were resolved to protect the coastal waters and EEZ of India. Having had no cohesive oceans policy since attaining independence, India was like many other developing nations totally ill-equipped to enforce the new rights and assume obligations in its vast maritime zones because of this type
of competence was being assumed for the first time in the maritime history of the country.

Satish Chandra et al. (1993) in this volume tackle four basic themes of Indian Oceans and its islands: strategic, legal, exploitation of resources and maritime traditions. While the contributors assess the scientific and developmental aspects of the islands in specific relation to India, these issues have a broad application to the problems facing all littoral countries. A unique feature of this volume is that it combines a discussion of strategic aspects with an exploration of India’s growing dependence on oceans and coasts.

Swaminathan, M.S. and R. Ramesh (1993) have edited papers presented in a seminar on ‘sustainable management of coastal ecosystem’ at Madras. Papers focus on all aspects of an integrated approach to ecological security of coastal zone and livelihood security of coastal communities. The impact of potential charges in sea levels as a result of global warming is also discussed. Coastal ecosystem management based on considerations of ecological sustainability and economic viability needs urgent attention in India. For this purpose, the authors have felt the need of coastal zone which would include 20 KM of sea surface and 20 KM of land surface from the high tide line.

Biliana Cicin-Sain and Robert W. Krecht (1993) in this article provides an overview of implications of the
Earth Summit for ocean and coastal governance. A comprehensive plan of actions for the protection of ocean and coastal areas was approved under Agenda 21. This plan action involves concurrent attention to the following:

1. Integrated management and sustainable development of coastal areas, including EEZ;
2. Marine environmental protection;
3. Sustainable use and conservation of marine living resources of the high seas and under national jurisdictions;
4. Addressing critical uncertainties for the management of the marine environment and climate change;
5. Strengthening international including regional cooperation and coordination; and
6. Sustainable development of small islands.

Coastal management (1973-93)\textsuperscript{30} Journal: In its various volumes, consists of articles focusing on all aspects of coastal planning and management in different parts of the world. This is a landmark publication in this field of inquiry. Most of the articles focus on the status of coastal management in developed and developing countries. They also comprise articles on the methodological aspect of the coastal planning and management.

This quarterly journal named Indian Journal of Marine Sciences (1980-93)\textsuperscript{31} comprises of articles focusing on scientific and technological aspects of Indian coasts and
oceans. They deal mainly with geological, physical, chemical biological aspects of oceanography. They also have articles on marine instrumentation and technology. These articles give us an insight on the coastal processes, pollution, deep sea mining and exploration, availability of oceanic resources, coastal and marine water quality etc. both of micro and macro level.

This literature survey is brief but mentions the relevant. Rational inclusion of various other studies on related topics would have unnecessarily increased the bulk and hence has been deliberately avoided. The ones which have really contributed in the thought process while carrying out the study have been included.

Objectives of the Study

Recognising the importance of coastal ecosystem and urgent need for Integrated Coastal Zone Management (ICZM), the main objectives of the study have been taken as follows:

i) To prepare a complete inventory of uses and activities that take place in the Indian Coastal Zone.

ii) To identify ecologically harmful development in the coastal zone.

iii) To analyse and assess the possible impact of sea level rise at micro level - A case study of Paradip Coastal Stretch, Orissa.

iv) To examine and critically apprise the current statutory role and jurisdiction of central, state and local
agencies in managing the coastal zone.

**Methodology**

Methodology adopted to pursue this study are: the first may be termed as descriptive/analytical. This involves the collection of facts and figures and the organisation of them as a description/analysis of the distribution of some phenomenon in an area.

The second type may be called problem solving. This involves keen observation of some phenomenon and requires adequate scientific explanation in terms of their occurrence through space and/or time.

**Data Base**

The data and information for this study have been derived from secondary sources - published and unpublished. However, to understand the ground realities with respect to the environmental factors, a reconnaissance survey was conducted. This survey gave a feel of the environmental realities of the Indian Coastal Zone.

The application of Bruun Theory in the estimation of the area of submergence and impact of possible sea level rise on population and land use of the Paradip coastal stretch has generated some valuable primary data at micro-level.

The major source of secondary data are listed below:

i) Census data and plan reports
ii) Data collected by Town and Country Planning Organisations of Maritime States/UTs.


iv) Govt. of India/UNEP report and documents.

v) Data and information regarding environmental degradation and pollution from various sources such as books, journals, reports, scientists at NIO, Goa, etc.

Limitation of the Study

The body of knowledge related to this study has continued to expand rapidly, and for that reason this study can not give the last word on the subject. This study was finalised early in 1994: thus, developments since that time are not covered. However, an attempt has been made to include technical, economic and legal developments that have taken place since only cursorily.

Chapterisation Scheme

The present study is divided into seven chapters. The first chapter deals with the conceptual framework of coastal planning and management. It also provides the design of the study.

The second chapter deals with national experiences and international cooperation for the protection and sustainable development of the marine and coastal area focussing on those developed and developing countries whose approaches
are integrated in content and are precautionary and anticipatory in ambit.

The third chapter provides an overview of Indian coastal zone. It deals with the inventory and assessment of resources as well as man-environment interaction in the form of space utilisation and development.

The fourth chapter deals with the environmental problems of the Indian coastal zone - degradation of resources, pollution and challenges which may arise with global warming.

The fifth chapter deals with the dangerous implications of sea level rise on coastal communities. A micro area has been studied on a case basis.

The sixth chapter examines coastal management and planning practices in India and legal responses to emerging environmental menace in the coastal zone.

The last chapter deals with conclusions and suggestions as usual.

REFERENCES


3. Ibid., p.107.


6. Ibid., p. 95.


8. Ibid., p.110


10. Government of India, Ministry of Environment & Forests (1991), Notification under the Environment Protection Act 1986, declaring Coastal Stretches as Coastal Regulation Zone (CRZ) and Regulating Activities in the CRZ, New Delhi, the 19th February.


12. Ibid., Ketchum, B.H.


16. EKISTICS - The Problems and Science of Human Settlements (March/April, 1982), A Special Issue on Coastal Planning and Management, Vol. 49, No. 293, Athens.


22. Sengupta, R. et. al. (1990), State of the Marine Environment in the South Asian Seas Region, UNEP Regional Seas Reports and Studies No. 123.


27. Satish Chandra et.al. (1993), Ed. The Indian Ocean and Its Islands Strategic, Scientific and Historical Perspectives, Sage Publications, New Delhi.


