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CENTRAL MARINE FISHERIES RESEARCH INSTITUTE

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

TATAPURAM P.O. COCHIN-682 014

1996

MARINE BIODIVERSITY CONSERVATION AND MANAGEMENT

Edited by

N.G. Menon and C.S.G. Pillai



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PREFACE

Conservation and sustained development of natural living resources and environmental protection have been the focus of extensive, scholarly attention in recent times. This has been the subject of debate and concern of all ecofriendly people the world over in the last decades of the 20th century. The diverse use of coastal and oceanic habitats for fishing, oil & gas, energy, tourism, education and research has naturally generated significant capital returns. This has also resulted in increased competition over ocean and coastal space and resources. Many believe that unbridled trade-based growth in this sector has resulted in the overexploitation of natural resources. In many countries conflicts between different interest groups have been reported with grave social, economic and political implications. In India also similar problems are often reported. Therefore, there is growing awareness among the beneficiaries and user agencies of this sector on the imperative need to conserve, protect and manage the various ecosystems and their valuable living resources. Considering the priority of this problem, the Central Marine Fisheries Research Institute has been conducting various multidisciplinary research projects for developing appropriate strategies over the last five decades to facilitate rational exploitation, conservation and management of the diverse exploited marine living resources in the Indian Exclusive Economic Zone as part of its charter of activities. The research results have revealed that consistently intensive exploitation, especially in the shallow coastal waters, has led to habitat and biodiversity degradation, species replacement and even overharvest of a few vulnerable species. Many strategic ecosystems such as the coral reefs, seagrass beds, mangrove forests, estuaries, backwaters, salt marshes and lagoons have also been subjected to intense exploitation, often resulting in serious damages to these life supporting systems. The results of ecological, biological and environmental studies conducted on these habitats are unfolding the magnitude and

dimension of the problems. Based on these studies the Institute could propose many regulatory measures and also recommend the declaration of certain vulnerable ecosystems as National Parks and Biosphere Reserves. It is hoped that the Institute's findings would be put to proper use for policy decisions leading to appropriate action. Large scale reclamation of estuarine and brackishwater areas, dredging, bottom trawling and domestic and industrial pollution constitute the major activities resulting in the progressive degradation of habitats and biodiversity in the coastal regions.

A wide range of resource and environment issues of coastal fisheries, aquaculture and mariculture including their problems and prospects are dealt with in this publication on the basis of the data generated within the Institute over the past few decades. Other relevant literature has also been taken into account, where necessary. The objective of this book is to indicate several management regimes and options to the various users of coastal zone to help them protect the marine habitats and resources, and also to create awareness among them on such threats as : (1) marine habitat modification and destruction; (2) overexploitation of fisheries resources; (3) erosion of species/genetic diversity; 4) anthropogenic modification of species relationships; (5) pollution hazards and (6) dredging and reclamation of natural life supporting systems.

The various chapters have been written by the concerned specialists and postgraduate students of this Institute, and I am thankful to them for presenting the subject matter very lucidly so that the central theme could percolate down to the grassroot level without any difficulty.

January 15, 1996

M. Devaraj

I. INTRODUCTION

There has been a realisation in the latter part of twentieth century on the imperative need to protect and conserve the habitats and their resources. In the Biodiversity convention at the UN Conference on Environment and Development (UNCED) the term biodiversity is defined as "the variability among living organisms from all sources including *inter alia*, terrestrial, marine and other ecosystems and the ecological complexes of which they are part, this includes diversity within species, between species and of ecosystems." The world conscience is now shifted from a mere mechanistic view to an ecological approach. Human interferences have disturbed most of the ecosystems and now only a few remain in pristine state. Irrational exploitation of natural resources has crossed the sustainable levels and even lead to extermination of a number of species of plants and animals. It is even predicted that if this state of overexploitation is allowed to continue we may loose many more species in the immediate future (Myers, 1979). Thus the conservation of biodiversity became one of the major global environmental concerns. The International Convention on Biodiversity Conservation held at Rio in December 1992 is the outcome of the global awareness that it is our ethical obligation to strive for a "Sustainable development that meets the needs of the present without compromising the ability of the future generation, to meet their own needs". (Brutland report - Our Common Future). The richness of biodiversity varies latitudinally or regionally and the concentration of restricted range of endemic species (hotspots) found in discrete areas are particularly vulnerable to habitat modification and destruction. Habitat destruction can easily lead to extinction of species. Even widespread and common species may become endangered or extinct if human impacts are widespread and chronic. Many efforts were made in the past to save a small number of large charismatic and threatened animals. (The elephant, The lion, The tiger, The panda, The bison, The

dugong, The turtle etc.) But such initiations directed towards a few species cannot adequately address the fundamental problems associated with general biodiversity loss. Usually the conservation strategies are focused upon 1) species by species conservation, 2) ecosystem conservation and 3) biological community conservation. Strategies must be suitably adjusted to the circumstances in each specific area of the world. Thus, the conventional conservation of a few large-sized animals/plants now gives way to a broader concept of ecosystem conservation as there are too many species at risk to classify as threatened or endangered. Mapping of species 'hotspots' and their distributional range has been commonly adopted to identify the affected ecosystem or species for optimal conservation. The use of Geographical Information System (GIS) computer software packages of programme is now widely accepted for assembling and interpreting fish distributional and environmental data sets of each biographic areas.

Of an estimated 30 million species on the earth, our knowledge of their diversity is limited to a catalogued 1.4 million with nearly 20% in the oceans. Although a wealth of data is available on the terrestrial biodiversity, the marine biodiversity is still imperfectly known and catalogued. Marine conservation strategies, compared to that of terrestrial ecosystem suffer from lack of attention and paucity of information on resources (Norris, 1993). The tropical marine ecosystems bordering the Indian subcontinent contain a large number of species of flora and fauna with characteristic structural and functional adaptations to a wide range of habitats from mangrove swamps, estuaries, saline lagoons, seagrass meadows, sandy/rocky coasts, coral reefs and oceanic islands to deep oceanic realms. Progressive anthropogenic impacts on these habitats and their biota have seriously affected the sustenance of the resources and even endangered a few species. It is often pointed out that there are no adequate and justifiable data for the formulation of suitable regulation and control measures to protect and conserve those species which are rare, vulnerable or threatened due to environmental and anthropogenic causes. Therefore, if the mankind is to effectively protect marine biodiversity while fully enjoying the ecological benefits provided by these organisms, data on the geographic dis-

tribution of biodiversity 'hotspots' is required to evaluate all those important resources.

The anthropogenic stress, backed by modern harvesting techniques, on the various ecosystems and the exploited resources have been summarised in various chapters of this book. Mangrove forest devastation, coral mining, destructive fishing techniques, overfishing, clandestine fishing of endangered marine mammals and turtles, reclamation of backwaters, pollution and their impact on resources and the habitat are highlighted in the respective chapters with suggestion on viable management options.

Global capture fisheries growth rate during the last decade is 3.2% per year; whereas the aquaculture growth is estimated about 9.6% per year. This poor growth on capture fisheries, both at global and National level (about 3.9% per year) points to the urgent need for an internationally accepted common guideline to conserve the life supporting systems, their biota and genetic diversity without hurting the basic needs of the populace and the equality between regions and generations. Therefore, our perspective plan for future should emphasise the need for scientifically planned management strategies developed by R & D organisations for sustainable harvest from the coastal sector. It might be possible to increase harvest from deeper oceanic areas in the EEZ with the introduction of large and medium sized trawlers/purse seiners etc. It is also possible to augment fish production through the mariculture of shellfishes and finfishes with the help of research inputs in breeding and seed production, viable feed formulation and by implementing eco-friendly, enviro-management regimes. Impact assessment studies of different fishing gears on the life supporting systems and the exploited biodiversity have helped to understand the recovering ability of the ecosystem and the tolerance ability of life supporting system so as to establish the principle of recycling in nature. The editors sincerely wish that the information provided in the various chapters of this book will help to generate a better awareness on the problems and prospects of marine biodiversity conservation in this country.