

studies of various wave models have been presented along with number of examples. Based on the various evaluation studies reviewed, useful conclusions have been drawn related to RMS error between measured and predicted wave heights.

Chapter 8 is devoted to wind specification. As wind is the only driving force for all wave models, degree of confidence associated with the predicted results can only be as good as the specified wind field. A good review of the wind specification procedures has been made in this chapter, which includes the significant contributions of Cardone. Examples of wind specification differences and their impact on wave model output have also been highlighted.

In chapter 9, analyses of wave records in time and frequency domain including the evaluation of design wave have been presented. A brief discussion on real-time wave analysis and prediction procedures used in various places has been included along with examples.

In the last chapter, a brief summary on the present status of operational wave prediction models has been given including the future scope of work on wave modelling with emphasis on the use of satellite sensed wind and wave data base and the importance of well planned field experiments on wave measurements.

The present monograph is a very useful reference volume for all those engaged in ocean wave modelling and marine forecasting, as well as for coastal engineers and offshore technologists. In general, the monograph is well written in lucid language. References covered up to 1989 are quite exhaustive and are sectionally divided for readers' convenience.

N M Anand
Ocean Engineering Division
National Institute of Oceanography
Dona Paula, Goa 403 004, India

Network analysis in marine ecology, edited by F. Wulff, J.G. Field & K.H. Mann, (Coastal and estuarine studies. Vol. 32) (Springer-Verlag, Berlin), 1989, pp. viii + 284, 660 g, Hard cover, DM 88.
[ISBN 3-540-51603-4]

Network analysis of ecosystem facilitates study of one or more of the many feedbacks and controls that operate to and fro between the ecosystem levels. The present book is the result of the studies stimulated by a workshop held at the University of

California, Santa Cruz in December 1986. The aim of the book is to help understand the feedbacks and control between different hierarchical levels. Network perspective provided by flow analysis is the foundation on which all the analyses in this book are built. The book concerns with linear relationship of flow to donor and recipient components of ecosystem.

The book has been divided into 4 parts. Parts 1 and 4 consist of one chapter each and parts 2 and 3 consist of 4 and 6 chapters respectively. First 2 chapters have amply demonstrated that useful information concerning ecosystem structure and functions can be obtained by subjecting network of material and energy flows in marine ecosystems to the analytical system. In chapter 3 it has been shown that how inverse methods can be used to generate flow networks from the available information. Procedure described invokes the principle of parsimony and derives the simplest possible flow network that is compatible with the data; that is the network excludes any structure that is not required to satisfy basic mass balance and biological constraints. With the help of 3 examples it is demonstrated that how to create a generic simulation model which can provide the user with some objective means for balancing a data set or for inferring the values of missing data. The methods discussed in chapter 5 allow a more realistic and comprehensive treatment of ecosystem interdependence.

Part 3 is quite large and presents the example where network analysis has been used and can be used for understanding the ecosystem. The information indices of development capacity, ascendancy and their component parts are discussed in chapter 6. The results of estuarine simulation model have been used to explain the behaviour of information indices. In practice it is impossible to measure all the flows among all components of an ecosystem of time intervals, short enough to follow succession in plankton community. Chapter 7 deals with the feasible approach to develop a simulation model to investigate the succession observed in the laboratory and to explain the variability observed in the plankton community in the field. The models have been validated using field data.

The 8th chapter is rightly introduced on the reconstruction of flow networks from the few known flows. Two complementary approaches have been used to derive the model of flow network. Network analysis of the North Inlet in Georgetown county has been discussed in chapter 9. Several basic elements have been used to quantify the degrees of dependence between major components and

subsystems, to define the key pathways of organic matter recycling and to identify the dominant structure of trophic exchanges.

Chapter 10 focuses on 2 topics: an empirical analysis of the effects of level of functional/taxonomic aggregation of species on measured flow indices and an analysis of seasonal changes in these indices. While most of flow analysis is based on seasonally averaged steady state situations, there is increasing interest in changes in these indices through time. Repeated measurements of network of flow over time is generally impracticable and using the output of simulation models of various kinds seems to be a promising approach to the problem. This has been rightly adopted in this chapter.

Chapter 11 deals with the comparison of the 2 exploited marine systems: the Baltic Sea and Chespeak Bay. Network analysis techniques for these 2 estuaries highlighted some real differences between the 2 estuaries, but some of the differences could be consequences of how the networks were constructed. The potential of network analysis in marine ecology has been discussed in the last chapter.

The publishers have done an excellent job of printing. The general layout of the papers is quite comfortable for reading. The particular volume is worthy of finding a place in all marine science libraries.

S. G. Dalal
National Institute of Oceanography
Dona Paula, Goa 403 004, India

Modern planktonic foraminifera, by Ch Hemleben, M Spindler & O R Anderson, (Springer-Verlag, Berlin), 1989, pp. xiii + 363, 109 Figs, 770 g, Hard cover, DM 178.
[ISBN 3-540-96815-6].

This book is a synthesis of literature that appeared in the recent years on the biological and geological aspects of modern planktonic foraminifera. As a group, the foraminiferans have generated considerable scientific interest because of their utility in reconstructing the climatic changes of the past. This is done both by analysis of the stratification of the foraminiferan tests in sediment cores, as well as by stable isotopic analysis of the tests themselves. Nevertheless, their utility as a probe into the past can be reliable only with a comprehensive study of the

present day living foraminiferans. The authors have rightly pointed out that the present is the key to the past.

The contents of the book are organized in to 15 chapters. Of which the main text is dealt within the first 12 chapters and the last three pertain to references, glossary and index. The first chapter as expected, is introductory in nature and justifies the necessity of such a book. The second chapter presents taxonomic features of the planktonic foraminifera. Forty-five recent species are recognized. For convenient reference, these are broadly classified into spinose and non-spinose categories. The spinose planktonic foraminifera are sub-categorised into Globigerinids with thin round spines, Globigerinids with round and triangular spines, and Hastigerinids with triradiate spines. Similarly non-spinose planktonifera are grouped into Globoquadrinids, Globorotaliids with normal pores, microperforate planktonic foraminifera and non-spiral planktonic foraminifera. The descriptions of all the species are accompanied by SEM photos. Chapter 3 on collection and culture methods deals with methodology for ecological and physiological studies, fixation and sorting of shell samples, SCUBA collection and isolation and preparation for maintenance cultures. The development of maintenance culture techniques, according to the authors, would open new avenues for long term genetic studies and investigations of inter-generational effects of variations in environmental variables.

Chapter 4 is devoted to cellular ultrastructures. Enough details of cytoplasmic and other organelles are given, which indeed are complimentary to shell structures in tracing phylogenetic affinities. The foraminiferans, both planktonic and benthic, harbour variety of algal symbionts. Chapter 5 deals with this aspect as well as commensalism and parasitism. This also covers topics such as symbiont morphology and fine structure, symbiont and host physiological interactions, origin of algal symbionts and their major features. Chapter 6 deals with physiological aspects with "Trophic activity and nutrition" as its theme. This covers prey and predation activities, acceptance of prey and its rate of digestion and also attempts to relate the distribution of foraminifera with prey abundance. Chapter 7 is on reproduction. Included in this chapter are such aspects as gametogenesis, morphological changes associated with it and reproductive cycles. The planktonic foraminiferans reproduce by release of flagellated cells which appear to be the gametes. Their