

## BOOK REVIEW

### LARGE MARINE ECOSYSTEMS: PATTERNS, PROCESSES AND YIELDS

K. Sherman, L.M. Alexander, and B.D. Gold

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This book is the third in a series of AAAS volumes resulting from symposia on large marine ecosystems. The first two were published in 1986 and 1989 and both were edited by Sherman and Alexander.

Large marine ecosystems (LMEs) are defined by Sherman and Gold in the introduction as “relatively large regions of the global EEZs, generally on the order of  $> 200,000 \text{ km}^2$ , characterized by unique bathymetry, hydrography, and productivity, within which marine populations have adopted reproductive, growth and feeding strategies.” The objective of the three AAAS symposia and the corresponding volumes that resulted was to make the case for the adoption of LMEs as regional units for the conservation and management of marine resources.

The present volume is divided into three sections. The first (Perturbations and Yields of Large Marine Ecosystems) presents case studies of the state of knowledge of six LMEs ranging from the high polar Weddell Sea to the tropical Banda Sea. The second presents a series of chapters on the mysterious new concept of biodynamics, an approach to the study of the sea which integrates physics and biology at meaningful scales. I think what all of this means is an attempt to link the different time and space scales upon which causal physical and resultant biological processes occur. Certainly, mathematics and mathematical modeling will play an extremely important role in this development. The final section (Theory and Management of Large Marine Ecosystems) takes a number of holistic views of LMEs in terms of processes and patterns, and yields and management.

In my view, three of the 18 chapters really stand out as being first-class contributions and of particular interest to the natural resource modeler. All three chapters deal with the issue of scale. Christopher Taggart and Kenneth Frank (Chapter 12, *Perspectives on Larval Fish Ecology and Recruitment Processes: Probing the Scales of Relationships*) discuss reasons for the present inability of the fisheries scientists to robustly predict recruitment variation in both “closed” freshwater and more “open” marine ecosystems. Their point is that seldom do the scales (time-space) of experiment match those at which recruitment processes occur. They emphasize a reorientation of our focus on characteristics of survivors of critical early-life history stages rather than on trying to quantify mortality.

Robert Ricklefs (Chapter 13, *Scaling Patterns and Process in Marine Ecosystems*) defines scale as “the characteristic distance or time associated with variation in natural systems” and proceeds to give a fascinating exposition of why the problem of appropriate scale is so important to understanding the dynamics of (marine) ecosystems. He shows how scale changes as signals propagate through systems, particularly as they move from physical to biological components of a system. He goes on to postulate that linkages of system patterns and processes that occur on different scales, once we discover them, may help define ecosystems boundaries.

Finally, Simon Levin (Chapter 14, *Physical and Biological Scales and the Modeling of Predator-Prey Interactions in Large Marine Ecosystems*) discusses why he thinks that modeling provides the necessary linkages between natural experiments conducted over relatively small scales and large ecosystem processes. He goes on to challenge modelers to integrate physics and biology when he states that “a modeling framework is strongest when it can relate phenomena on different scales, providing ‘mechanistic’ bases underlying observed patterns.” He proposes a protocol of sequence of steps for developing an understanding of the complex dynamics of large marine ecosystems—(1) statistical analysis of observed patterns, (2) construction of competing models of critical processes, (3) investigation of competing models through experimental and theoretical studies of component systems, and (4) integration of validated component models.

The above-mentioned three chapters are jewels and make this book a worthwhile reading experience for anyone interested in the dynamics of marine ecosystems. In my view, the remaining 15 chapters make a well-padded carrying case for these jewels.

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