

## Preface to the Third Edition

The world—and the field of marine ecology—have changed since the first edition of this book, and the changes needed to be reflected in this edition. Marine science has been a leading discipline in ascertaining the degree to which humans have altered conditions on land, atmosphere, and sea, and defining the consequences for marine environments. This third edition differs from previous editions by emphasizing the history of discovery about the recent changes that have transformed the subject matter of each chapter, not only by updating the plethora of new basic findings, but also highlighting anthropogenic and climate-driven effects and their importance. This edition does maintain the effort made in the previous editions of presenting, step-by-step, the basic elements and processes involved in marine ecology in early chapters, and progressively building up the layers of information, an effort to allow readers, chapter by chapter, to gain a synthetic and comprehensive overview of the subject matter.

I fear I have not completely managed to curb the elephantine growth characteristic of subsequent editions, but this edition is only about 10 pages longer than 2nd. edition. Some material from earlier editions has been culled, but I erred in favor of preserving some trace of the historical roots of the disciplines, and giving credit to originators of ideas and concepts. It seems this is important in an epoch of shortening attention spans and precipitous pace of life. So, references that may appear dated still appear, a tribute to the founders of marine ecology, even as room had to be made to allow for the extraordinary growth in publications and new knowledge. There is no way to understate, the magnitude of the avalanche of publications now facing us. Although the number of references cited here has increased significantly, the coverage I offer by no means comes near a comprehensive review of the fields involved. I apologize to many colleagues for ignoring worthy publications, but hope they might have some sympathy with the problem. To lead interested readers to more comprehensive treatments of the various topics, I refer to reviews of specific topics throughout the text.

I must thank many colleagues for suggestions, contributions, graphics, and data. Among the many from around the world that made a difference for this third edition, I include Susana Agustí, Walter Boynton, Ruth Carmi-

chael, Just Cebrián, Sally Chisholm, Maureen Conte, Thaïs Corbisier, Linda Deegan, Robert Diaz, Carlos Duarte, Sophia Fox, Daniel Fornari, Jim Galloway, Anne Giblin, John Hobbie, David Kirchman, Dongyan Liu, Laurence Madin, Paulina Martinetto, Nancy Rabalais, Victor Smetacek, Lucy Soares, Mirta Teichberg, Inés González Viana, John Waterbury, and Susan Williams.

My able research assistants, Megan Bartholomew and Elizabeth Elmstrom, played an essential role in the production of this edition, dealing with the graphics and a myriad of details. Chris Neill and Joan Ruderman of the Marine Biological Laboratory, Woods Hole, provided substantive institutional support during the writing. I owe many thanks to the great staff of the Marine Biological Laboratory-Woods Hole Oceanographic Institution Library (MBL-WHOI) for responding to my innumerable requests with quick and effective action. I appreciate the long-standing persistence and patience of Janet Slobodien, my editor at Springer, in the long process of writing this edition.

# Preface to the Second Edition

Many areas in marine ecology have remained unchanged in the decade since the first edition appeared, but other areas have seen remarkable expansion in the past 10 years. The changes have sufficiently changed the field to suggest that a revision was timely.

The text of the first edition was already hirsute with references; in the intervening decade there has been an explosion of publications, with journal titles increasing exponentially, and most journals increasing the annual numbers of pages. The increasing pace of acquisition of information and publication has made comprehensive review of any field, let alone one as eclectic as marine ecology, more daunting and less feasible as we move into the next century. The overwhelming number of publications has forced selective use of references, and I have surely failed to include many meritorious papers. To be able to finish work on this new edition within reasonable time, I have also used a few more examples from my own work than in the first edition, simply because I had them readily available, rather than find other, perhaps better illustrations in the enormously expanded literature. The proliferation of published materials is a serious problem; our students' students will live in a different, certainly more specialized, perhaps paperless world, but they will need more effective ways to seek and synthesize more and more information on narrower topics.

In this second edition I have updated expanding knowledge in topics covered in the first edition, and have added a few topics that have assumed greater importance since the first edition. Deletions and omissions have been more difficult, although necessary. The comprehensiveness of this second edition is less than I would have wished: Many interesting issues and findings had to be left out to prevent the common elephantine growth of second editions.

The plan of this second edition is to first present information at the physiological and population levels, for both producers and consumers, in Chaps. 1–7. Community ecology is introduced in Chaps. 8–9 by discussion of notions of how producer and consumer populations relate to each other in food webs. Further structural aspects of communities are addressed in Chaps. 10–12. Integration at the level of marine ecosystems is discussed in Chaps. 13 and 14, which focus on carbon and nutrient dynamics, based on

abundant material from previous chapters. Then, having provided the essentials for understanding the workings of key processes at different levels of integration in marine ecosystems, Chap. 15 shows how these processes interact in determining annual seasonal patterns. Over the past 10 years it has become evident that whatever ecologists study over the coming decades will be increasingly modified by the effects of human activities. Ecologists no longer have the luxury of confining their work to pristine environments or to basic research. The major controls of ecological system function and structure will increasingly be altered by, or in fact, be, anthropogenically determined. To encourage understanding of this theme, and to show how understanding of fundamentals interdigitates with applied aspects, I have increased the coverage of how human activities interact with “natural” processes over the long term and at large spatial scales. Chapter 16 is devoted to these issues.

I have, for the most part, retained the focus on processes that occur at ecological rather than evolutionary and geological time scales, and I restricted the coverage of evolutionary topics, choosing to emphasize proximate rather than ultimate causes. The actual space dedicated to material is probably a function of publishing activity in the community, as well as of importance: there is perhaps too much on large animals, less than would be desirable on microbial, geochemical, and physical aspects. In retrospect, though, I believe that the contents do convey how the field “looks” in the past decade of the twentieth century.

I thank the many of my friends, colleagues, and students that made suggestions as to topics that needed inclusion in this second edition, or provided information and critical comments: Merryl Alber, Randy Alberte, Karl Banse, Cheryl Ann Butman, Walter Boynton, David Caron, Edward Carpenter, Penny Chisholm, Cabell Davis, Paul Dayton, Carlos Duarte, John Field, Ken Foreman, Anne Giblin, Mark Hay, John Hobbie, Robert Howarth, Peter Jumars, Mimi Kohl, Jim Kremer, Michael Lamontagne, Michael Landry, Brian LaPointe, James McClelland, Bruce Menge, Michael Mullin, Mark Ohman, Candice Oviatt, Michael Pace, Robert Paine, Pete Peterson, Larry Pomeroy, Jennifer Purcell, Kenneth Sebens, Sybil Seitzinger, and George Somero.

Once again, the supportive staff of the MBL-WHOI devoted time and much effort to find materials and check references. New graphics were expertly prepared by Laurie Raymond and Robin MacDonald unstintingly went over innumerable details during preparation of the revised manuscript. Lori Soucy was invaluable in tracing elusive references.

This book would have a much narrower scope and depth of experience if I had not had the support of the National Science Foundation (NSF), the Environmental Protection Agency (EPA), the National Oceanographic and Atmospheric Administration (NOAA), the Woods Hole Oceanographic Institution’s (WHOI) Sea Grant, and other agencies and foundations, in a wide range of research activities during the past 25 years. It therefore belatedly thank Linda Duguay, Mary Alatalo, Phil Taylor, Tom Callahan, and Joan Mitchell at NSF, Bill Thomas, Michael Crosby, and Leon Cammen at NOAA, JoAnne Sulak, Rosemary Monahan, and Ron Manfredonia at EPA, and David Ross and Judy McDowell Capuzzo at WHOI Sea Grant, for their support.

## Preface to the First Edition

This text is aimed principally at the beginning graduate or advanced undergraduate student, but was written also to serve as a review and, more ambitiously, as a synthesis of the field. To achieve these purposes, several objectives were imposed on the writing. The first was, since ecologists must be the master borrowers of biology, to give the flavor of the eclectic nature of the field by providing coverage of many of the interdisciplinary topics relevant to marine ecology. The second objective was to portray the marine ecology as a discipline in the course of discovery, one in which there are very few settled issues. In many instances it is only possible to discuss diverse views and point out the need for further study. The lack of clear conclusions may be frustrating to the beginning student but nonetheless reflects the current—and necessarily exciting—state of the discipline. The third purpose is to guide the reader further into topics of specialized interest by providing sufficient recent references—especially reviews. The fourth objective is to present marine ecology for what it is: A branch of ecology. Many concepts, approaches, and methods of marine ecology are inspired or derived from terrestrial and limnological antecedents. There are, in addition, instructive comparisons to be made among results obtained from marine, freshwater, and terrestrial environments. I have therefore incorporated the intellectual antecedents of particular concepts and some nonmarine comparisons into the text.

The plan of this book is to present information on specifics about physiological and populational levels of biological organization in Chaps. 1–7. Notions of how populations relate to each other, and their environment, are documented (Chaps. 8–9) and so community ecology is introduced. This is followed by Chaps. 10–12, where major aspects of the chemistry of organic matter and nutrients in marine ecosystem are developed, based on much of the material of previous chapters. Then, having provided the essentials for understanding the working of various processes in marine ecosystems, the final chapters (Chaps. 12–15) dwell on how the structure of marine communities and ecosystems may be maintained over space and time.

Although I am responsible for whatever errors remain, this book has been greatly improved by many people. I have to thank my colleagues in Woods Hole, especially John Teal and John Hobbie, for many years of discussion and exchange of ideas. One or more chapters were criticized by Randy Alberte, Karl Banse, Judy Capuzzo, Hal Caswell, Jon Cole, Joseph Connell, Tim Cowles, Werner Deuser, Bruce Frost, Joel Goldman, Charles Greene, Marvin Grosslein, Loren Haury, John Hobbie, Robert Howarth, Michael Landry, Cindy Lee, Jane Lubchenco, Kenneth Mann, Roger Mann, Scott Nixon, Mark Ohman, Bruce Peterson, Donald Rhoads, Amy Schoener, Sybil Seitzinger, Charles Simenstad, and Wayne Sousa.

The graduate students associated with my laboratory during the writing of this book have served as a critical sounding board, and have substantially contributed in many ways. I therefore have to acknowledge the contributions of Gary Banta, Donald Bryant, Robert Buchsbaum, Nina Caraco, Charlotte Cogswell, Joseph Costa, Cabell Davis, William Dennison, Kenneth Foreman, Rod Fujita, Anne Giblin, Jean Hartman, Brian Howes, Alan Poole, Armando Tamse, Christine Werme, David White, and John Wilson. All of them have helped in some fashion with this text, especially Kenneth Foreman and Anne Giblin, who read and criticized most of the chapters. Virginia Valiela did much of the work on the index. Sarah Allen provided technical help throughout the writing of this book, and Jean Fruci was invaluable in helping put together the final manuscript. Lastly, I especially want to thank Virginia, Luisa, Cybele, and Julia Valiela for putting up with me while I was writing this book and my parents for providing a learning environment long ago.

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