

Preface

This new edition of *Marine Biology* reflects my excitement and philosophy of teaching as a gateway to marine biology, which is an active science with broad scope and lots of exciting recent achievements. Students must learn concepts and facts while appreciating the organismal diversity of the marine realm. Most importantly, they must feel the pulse of current happenings, and that is why I have included over twenty essays called **Hot Topics in Marine Biology** which are scattered throughout the text. These essays put students in contact with the current world of research, much as the enclosed **Marine Biology Explorations CD** and links to my **marine biology web page** link students to the world wide web of marine biology.

This edition retains the basics of the first edition, enhanced by current happenings in marine biology and a gateway to the myriad of marine biology connections on the internet. This text is designed for a one-semester course at the sophomore to senior level in four-year colleges. It would help greatly if the students have already taken a college-level biology course with coverage of organismal diversity. That said, I have successfully taught the sort of course for which this text is designed for many years, and many of the students taking it had no other background in biology. This book could also be used in a more advanced undergraduate course in marine ecology, if it were supplemented with journal articles. The new addition contains many updated references to the primary literature and the enclosed CD links the student to my MBREF web site, which includes a large variety of reference lists on special topics in marine biology. The **marine biology web page** also brings the student to a variety of world wide web links in many topics in marine biology, including research pages.

Marine biology is a subject in which the principles of cell biology, biomechanics, ecology, and so on are applied to marine biological problems. The interaction of these fields often leads to combinations that are uniquely marine biological. The text addresses three major themes: function, biodiversity, and ecology. **Function** refers to the way organisms solve problems and how physical and chemical factors constrain and select the solutions. What shape should a maneuvering fish have?

How does a cuttlefish stay at a specific depth? Of course, there are also ecological dimensions to these questions. **Biodiversity** is an essential part of marine biology, and I introduce the topic in this book both through chapters on marine organisms and through materials on creatures in various habitats. A separate chapter discusses diversity and the processes that regulate it, both ecological and evolutionary. This edition adds a great deal of coverage on recent advances, including our increased understanding of molecular methods of species and genetic identification, invasive species, and sibling species in the sea. **Ecology** is the interaction of organisms with their environment, studied usually by trying to understand the distribution and abundance of organisms. This involves a series of processes, which I introduce as a hierarchy, from individuals to ecosystems. It also involves a discussion of the processes along with accounts of major marine habitats and communities. This edition pays special attention to modern concepts of populations and species interactions including metapopulations, large-scale control of dispersal, and alternative stable states of communities.

Marine biology is such a diverse subject that some approach must be adopted to organize the subject. I firmly believe that principles must guide our understanding, rather than an accumulation of facts. The first part of the book introduces basic principles of how the ocean works and how marine organisms function, as individuals and at higher levels of the ecological hierarchy. Then we cover the organisms and the processes important in the water column. This is essential in order to understand the overall economy of the main part of the marine realm. Processes in the water column are also crucial for the benthos, which depend strongly upon the world above, both directly and indirectly. Next, we cover benthic creatures and the principles necessary to understand the biology of marine bottom organisms, which is followed by coverage of major marine habitats. The accompanying CD includes the application *Marine Biology Explorations*, which contains about 450 images (annotated with text). It is designed to illustrate specific ecological and functional relationships in a variety of major marine habitats including coral reefs, kelp forests, salt marshes, and mangroves. I have been selective and have emphasized those habitats that are not only important and interesting, but those where important principles can be illustrated to their best advantage. I look at the important gradient from the continental shelf to the deep sea, paying special attention to some of the fascinating newer discoveries about biological function and fascinating habitats, such as hot vents, in the deep sea. A chapter on gradients in biodiversity sums up larger scale variation in the sea and includes sections on invasive species, conservation of biodiversity, and conservation genetics. Finally, I tackle human interactions with the sea, as both a source of food, and unfortunately, a waste receptacle. I cover human effects on the ocean and include the important new field of global change.

This text has a series of features designed to help the student absorb a great variety of materials. Nearly every section has **summary heading sentences** that convey the essence of the material to follow. I find this of help to the student in anticipating what's ahead and in studying for exams in a subject that deals with so much biological and terminological diversity. **Text boxes** are included to explain a few equations and concepts and to keep the main body of the text free of excessive details. There are also more than twenty **Hot Topics in Marine Biology** essays scattered through the text. These essays are designed to point toward some recent advances in the understanding of marine biology or to discuss current issues, especially relating to new ecological debates, pollution, and fisheries. Each chapter is

followed by a set of **review questions** and at the end of the book is a **glossary**. I have tried to write with very few embedded references to the scientific literature, referenced where necessary with numbered **footnotes**. At the end of each chapter, I have provided a number of references for further reading to allow the interested student to pursue a subject further, or even to get started on a term paper. This edition has far more references than the last, with **more references and leads on the CD**.

I have taught marine biology and ecology for over 25 years and have always been amazed at the diversity of students who take the course. Biology majors, geology majors, and humanities majors sit side by side. All learn a great deal and all seem to have that love for the ocean. You don't have to convince them to be there: They *want* to learn about marine biology. I do my best to keep that interest alive, and I find that field trips and use of many color slides help a great deal. I hope the enclosed CD will help instructors get students interested. I have taken many of my students with me to marine labs, and they have launched careers in science. I hope this text will help a wider audience to get excited about marine life.

Many people have helped me—too many to mention individually—with the preparation of this manuscript, and I absorbed a few, but probably not enough, of their helpful suggestions. I am especially grateful to the many individuals who shared their photographs and research experiences with me. The first edition was reviewed by Susan Bell, Paul Dayton, Alan Kohn, Larry McEdward, and Alan Stiven. I am very grateful for their constructive criticisms.

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