Preface

The beauty, mystery, and power of the sea fascinate people all over the world. That, of course, includes students who enroll in undergraduate courses in marine biology. For many of these students, taking a marine biology course is the natural expression of an interest in marine life that began through scuba diving, recreational fishing, aquarium keeping, or viewing the superb television documentaries. Through these interests, many students will also be concerned about the increasing impacts of humans on marine ecosystems. *Marine Biology*, Fifth Edition, was written to reinforce and enhance our readers' enchantment with marine life while providing a rigorous introduction to marine biology as a science.

Marine Biology is used by high school, undergraduate, graduate, and adult education students, and by interested laypersons not enrolled in formal courses. We have been delighted to learn that even some professional marine biologists find the book to be a useful general reference. While keeping this range of potential users in mind, we have written the text primarily for lower-division, non-science majors at colleges and universities. Marine biology will be the only tertiary science course that many of these students will undertake, and will often serve to satisfy a general education requirement. We have therefore been careful to provide *solid basic science coverage* including some principles of the scientific method, the physical sciences, and basic biology. Our general aim has been to integrate this basic science content with a stimulating, up-to-date overview of marine biology. We hope this approach demonstrates the relevance of the physical sciences to biology and makes the study of all sciences less intimidating. To this end, we use an informal writing style that emphasizes an understanding of concepts over rigorous detail and terminology.

We recognize that general science content will not be needed in all marine biology courses, either because the course is not intended to satisfy general education requirements or because students already have some scientific background in the sciences. To balance the needs of instructors teaching courses with and without prerequisites in basic biology or other sciences, we have designed the book to provide as much *flexibility* as possible in the use of the basic science coverage, the order in which topics are presented, and in overall emphasis and approach. We have tried to meet the needs and expectations of a wide variety of students, from the scuba-diving philosophy major to the biology major considering a career in marine science. We also hope that a variety of readers, other than university students, find the book useful and enjoyable.

Four major themes run through *Marine Biology*, one being the coverage of basic science as applied to the marine environment. Another is an *emphasis on the organisms themselves*, and their vast diversity not only in taxonomic terms but also in structure, function, and ecology. A third theme is an *ecosystem approach* that integrates this organismal diversity with the challenges imposed by the surrounding environment, both physical and biological. A final theme that, for better or worse, becomes increasingly relevant with each passing year is the *interaction of humans with the marine environment*.

Marine Biology, Fifth Edition, takes a *global, non-regional perspective* to emphasize that the world's oceans and seas are an integrated system that cannot be understood by looking in any one person's own backyard. For many students this is a new perspective. One aspect of our global approach is the deliberate inclusion of examples from many different regions and ecosystems so that as many students as possible, not just in North America but around the world, will find something relevant to their local areas or places they have visited. We hope this will stimulate them to think about the many relationships between their own shores and the one world ocean that so greatly influences our lives.

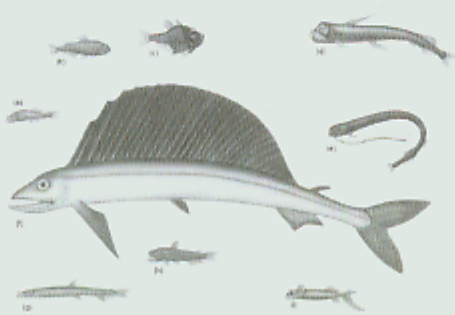
Changes in the Fifth Edition

The fifth edition of *Marine Biology* incorporates *the most extensive art revision since the first edition* was published in 1991. Most of the illustrations have been improved to make them clearer, more accurate, more understandable and more attractive, using space more efficiently (see below). Many photographs from previous editions have been replaced, and others digitally enhanced. The part-opening and chapter-opening photos are all new. We have also adopted a new interior design that is more reader-friendly and makes better use of space. We hope readers are as delighted with the results as we are.

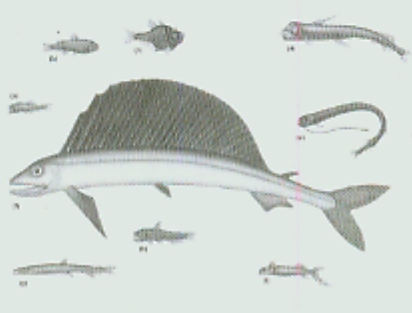
As in the last edition we have *expanded our coverage of the role of microbes* in marine ecosystems in response to the steady stream of relevant new research findings. This includes incorporating the finding of organelles in some bacteria in Chapter 4, a new section and summary table in Chapter 5 on prokaryote metabolism, and updated coverage of pico- and nanoplankton in Chapter 15. We have added *a new section on larval ecology* to Chapter 10, which also contains *additional information about anthropogenic influences on global nutrient cycles* and a new figure showing the phosphorus cycle, and consolidated the description of different groups of corals and the distribution of zooxanthellae with a new table in Chapter 14. We have somewhat reduced the coverage of certain classical techniques, for example in methods of water sampling and measuring primary productivity, in favor of more modern procedures methods.

As in previous editions we have updated the text throughout to reflect *recent events, new research, changes in perspective* and to

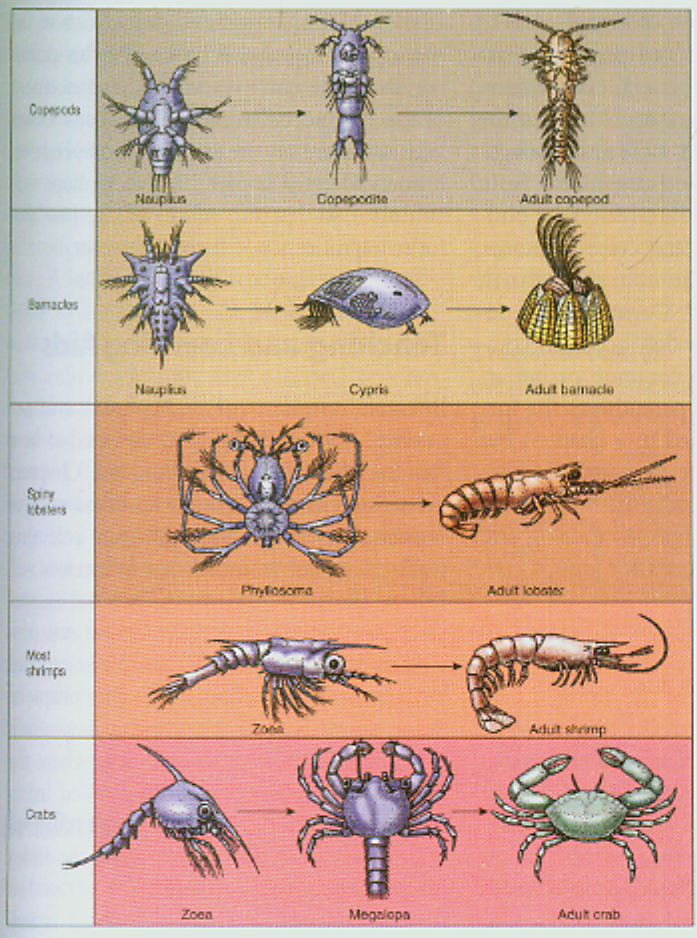
Fourth Edition



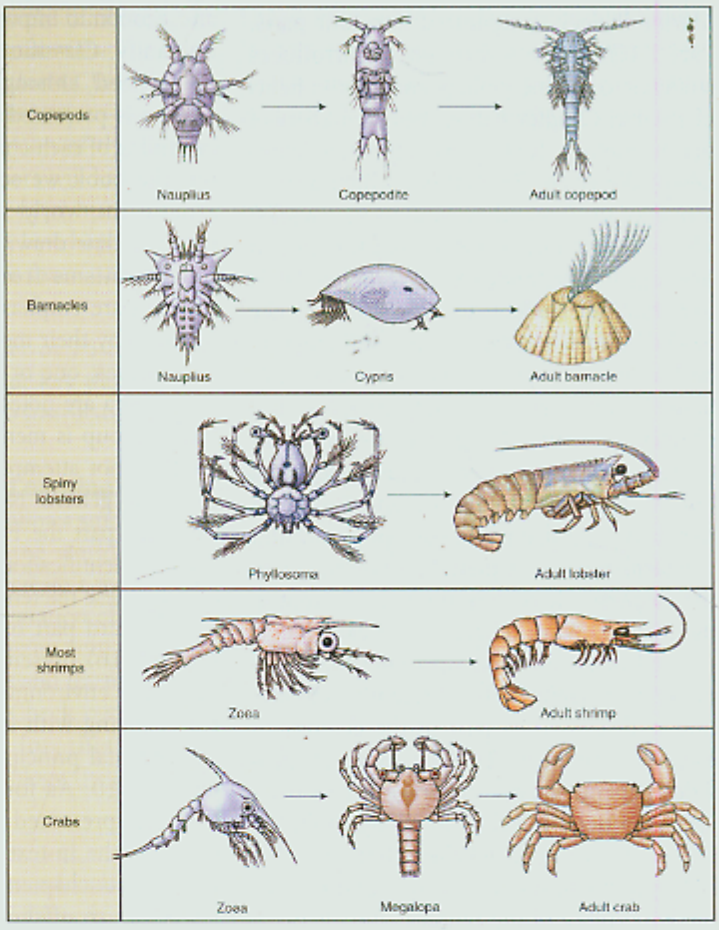
Enhanced Fifth Edition



Fourth Edition



Enhanced Fifth Edition



Fourth Edition

	Epipelagic	Mesopelagic (vertical migrators)	Mesopelagic (non-migrators)	Deep Pelagic	Deep-sea bottom
Appearance					
Size	Wide size range, from tiny to huge	Small	Small	Small	Relatively large
Shape	Streamlined shape	Relatively elongated and/or laterally compressed	Relatively elongated and/or laterally compressed	No streamlining, often globular in shape	Very elongated
Musculature	Strong muscles, fast swimming	Moderately strong muscles	Weak, flabby muscles	Weak, flabby muscles	Strong muscles
Eye characteristics	Large eyes	Very large, sensitive eyes	Very large, sensitive eyes, sometimes tubular eyes	Eyes small or absent	Small eyes
Coloration	Typical counter-shading: dark back and white or silver belly	Black or black with silver sides and belly; counter-illumination	Black or black with silver sides and belly; counter-illumination	Black, occasionally red	Dark brown or black
Bioluminescence	Bioluminescence relatively uncommon	Bioluminescence common, often used for counter-illumination	Bioluminescence common, often used for counter-illumination	Bioluminescence common, often used to attract prey	Only a few groups bioluminescent

Enhanced Fifth Edition

	Epipelagic	Mesopelagic (vertical migrators)	Mesopelagic (non-migrators)	Deep Pelagic	Deep-sea bottom
Appearance					
Size	Wide size range, from tiny to huge	Small	Small	Relatively small, larger than mesopelagic	Relatively large
Shape	Streamlined	Relatively elongated and/or laterally compressed	Relatively elongated and/or laterally compressed	No streamlining, often globular in shape	Very elongated
Musculature	Strong muscles, fast swimming	Moderately strong muscles	Weak, flabby muscles	Weak, flabby muscles	Strong muscles
Eye characteristics	Large eyes	Very large, sensitive eyes	Very large, sensitive eyes, sometimes tubular eyes	Eyes small, sometimes absent	Small eyes
Coloration	Typical counter-shading: dark back and white or silver belly	Black or black with silver sides and belly; counter-illumination	Black or black with silver sides and belly; counter-illumination	Black, occasionally red, often lack coloration at greatest depths	Dark brown or black
Bioluminescence	Bioluminescence relatively uncommon	Bioluminescence common, often used for counter-illumination	Bioluminescence common, often used for counter-illumination	Bioluminescence common, often used to attract prey	Only a few groups bioluminescent

include information requested by reviewers. The fifth edition presents new information about the Tethyan fauna, past climate variability, hot spots in the earth's mantle, Antarctic upwelling, nucleic acids, viruses, fisheries, cleaning associations, the taxonomic position of pogonophorans, *Pfiesteria*, osmotic regulation in fishes, indirect ecological interactions among species, shark attacks, bioerosion on coral reefs, coral bleaching, epipelagic cyanobacteria, endangered marine species, temperature regulation in "warm blooded" fishes, hydrothermal vents, benthic diversity on seamounts, and many other topics. As usual we have updated facts and figures, corrected errors, and reorganized some sections to improve balance and logic flow.