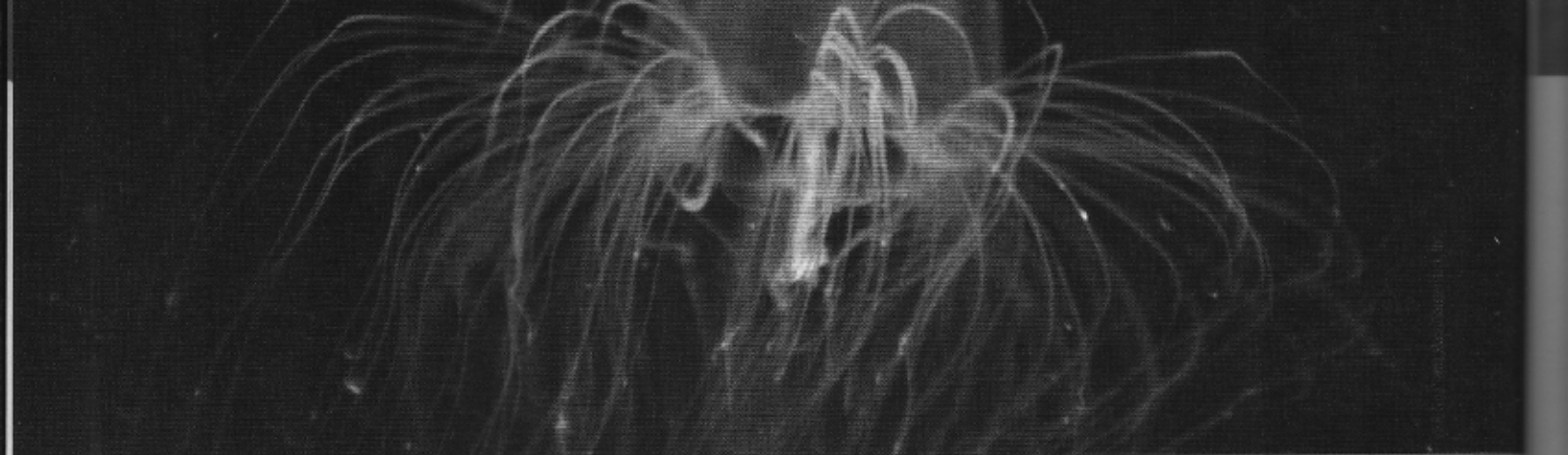




Preface

As this new edition is being prepared, the longest global coral bleaching and die-off event in recorded history is occurring, and there is evidence that the oceans have become more acidic due to increased carbon dioxide emissions. As scientists worldwide attempt to deal with new marine environmental problems arising and old problems persisting, continued understanding of the sea and its inhabitants is absolutely necessary. For nonscientists, if there is a desire to preserve our world ocean, which provides so many services to us, and to continue to enjoy having fun in the sea and eating seafood, we must expand our knowledge of the sea and how our daily activities affect its health. Familiarity with the effects of a changing climate will help one understand the complexities of rising sea temperatures and sea levels. An understanding of the biology of corals and other animals will enable scientists to predict the magnitude of impacts to these organisms when the water is too warm or the chemistry changes too much. Knowledge of the chemistry of seawater will provide one with the ability to understand the many changes to the water column that are being observed as ocean acidification becomes more widespread. Perhaps most important, a study of the biology of marine life will help one appreciate the reasons why so many organisms are harmed due to these changes to our world ocean, such as corals, which support entire ecosystems. All of this insight and much more is contained within this eleventh edition.

Audience

We have written *Introduction to the Biology of Marine Life* to engage introductory, college-level students in the excitement and challenge of understanding marine organisms, the environments in which they live, and the challenges they face as the marine environment changes. We assume no previous knowledge of marine biology; however, some exposure to the basic concepts of biology is helpful. This book uses selected groups of marine organisms to develop an understanding of biological

principles and processes that are basic to all forms of life in the sea. To build on these basics, we present information dealing with several aspects of taxonomy, evolution, ecology, behavior, and physiology of these selected groups. We hope that a student's venture into this exciting field provides some flavor of the mix of disciplines that constitutes modern biological science. Moreover, we hope that this text cultivates an appreciation for the need to understand marine geology (the seafloor), marine physics (waves, tides, and currents), and marine chemistry (the composition of seawater) before a complete understanding of marine biology can be achieved.

Organization

Although we intend the sequence of topics to be flexible, we have presented our material in four sections.

We begin with an introduction to the sea as a habitat (Chapter 1), highlighting the many ways that the ocean realm differs tremendously from more familiar terrestrial environments, especially in terms of the chemistry of seawater and the geology of the seafloor. We have added an entire chapter on motion within the sea (Chapter 2), highlighting the mechanisms behind ocean movements and how ocean movements affect marine life. Then we provide a brief summary of basic chemical and biological principles that are not unique to the ocean for the beginning student (Chapter 3). The next portion of the book summarizes all life in the sea, with two chapters dedicated to autotrophic producers, large and small, and marine bacteria and viruses (Chapters 4 and 5); one chapter for microbial and invertebrate consumers (Chapter 6); and two chapters covering marine vertebrates (fish, amphibians, and reptiles in Chapter 7; birds and mammals in Chapter 8). We have organized the third section of this new edition around the major marine habitats: estuaries (Chapter 9), coastal seas (Chapter 10), coral reefs (Chapter 11), the open ocean (Chapter 12), and the deep sea (Chapter 13). Chapter 14 includes descriptions of the polar seas and their

inhabitants, as well as a discussion of global climate change, including suggestions for lowering one's ecological footprint. Finally, we describe the history and current status of marine fisheries and aquaculture in Chapter 15.

New to the Eleventh Edition

The tenth edition of this text was well received by a wide audience, and this was very encouraging while preparing the eleventh edition. Many wonderful suggestions were made by reviewers and readers of earlier editions, and it was these suggestions, along with creative ideas suggested by the editors at Jones & Bartlett Learning, that led to a textbook that has been greatly improved and updated. This eleventh edition represents our continuing efforts to meet the needs of our readers more completely, and to adapt to changing educational platforms. We are certain that students and instructors alike will be pleased to see the many ways that the book has been augmented with new information, new features, and refreshed dialogue.

Chapter 1 has been updated and improved by making the material more concise and moving information on ocean chemistry and oceanography to the new Chapter 2, "Physical and Chemical Oceanography." The new Chapter 2 includes examples of the linkages between ocean water movement and the fate of marine organisms and additional information on El Niño. Chapter 3 now includes a clarified discussion of photosynthesis and a new section that introduces evolution by natural selection. Chapter 4 has been expanded to cover marine bacteria, Archaea, and viruses and includes updated photosynthesis terminology and an introduction to phylogenetics.

Chapter 5 now contains the latest hypotheses on the phylogenetic relationships of marine algae. Chapter 6 includes a discussion of the abandonment of the term "protista" and more detailed information on invertebrate phyla, including new discussions of the phylum Tardigrada and meiofauna. Chapter 7 includes more detailed information on fish physiology, a discussion of *Hox* genes, and a new example of hermaphroditism in fish. Chapter 8 now includes information on echolocation; additional information on manatees, dolphins, porpoises, and sperm whales; and updated information on population statuses of several groups of marine mammals. Chapter 9 has been augmented with expanded coverage of nutrient pollution, the biology of mangroves, and suggestions for improving the health of estuaries. Chapter 10, which covers the biology of coastal seas, offers coverage on hot topics in marine science such as connectivity. Chapter 11 has been updated with a large amount of recent research examples, new hypotheses on coral spawning strategies, the effects of ocean acidification on coral, and new information on Marine Protected Areas. Chapter 12 now includes more information on the orientation of organisms in the open sea, including zooplankton behavior. An updated Chapter 13 includes new information about technological advancements in deep-sea research and new discoveries in the deep sea. Chapter 14 is a new chapter on the polar seas. It contains information moved from other chapters on animals that inhabit polar climates, new information on climate change and sea ice research, and suggestions for reducing our greenhouse gas emissions. Chapter 15 highlights the latest trends in fisheries science, updated fisheries statistics, the recent increase in aquaculture, and concludes the book with suggestions for becoming a steward of the ocean.