

Preface

In recent years a new appreciation of environmental and conservation issues for marine ecosystems and resources has emerged. This appreciation has developed, at least in part, in response to a number of issues broadly covered in the news media and widely debated among scientists and the public—including the collapse of many historic fisheries, unprecedented oil spills, mysterious die-offs of corals, unexplained deaths of marine mammals, natural disasters from hurricanes and tsunamis, intense El Niño events, and ongoing climate change and sea-level rise. Our evolving ability to rapidly communicate information concerning such issues has led to vigorous debates over the ethics and the supporting science that drive conservation decisions. The push to establish agreements on the proper human response to these issues has led to a flurry of activity to generate the necessary scientific, cultural, political, and economic knowledge and insight. The persons with arguably the greatest influence in these debates will be current students, who have been experiencing increasing interactions of humans with ocean ecosystems, the explosion of scientific knowledge, and rapidly developing environmental ethic. There is a need to maximize the knowledge base for students, not only those working toward marine-focused careers but also those in other disciplines, to enable informed decisions in their professional and personal lives.

This text was written out of the need for a synthesis of knowledge and unbiased information related to marine environmental and conservation issues; something that is not only useful to students focusing on marine biology or oceanography tracts but also available to those in general biology, environmental science, and other science and environment related fields. Such a text has been previously unavailable. Although this text is approached primarily from a biological perspective, the living portions cannot be divorced from other parts of the ocean environment; thus, fundamental physical, chemical, and geological components are integrated into the coverage. Moreover, marine conservation issues cannot be solved by ignoring the nonscientific aspects of decision-making; therefore, a limited discussion of the political, social, and economic components of conservation is incorporated as well.

The specific goals of this text are to provide an introduction to and understanding of issues concerning marine environmental protection and conservation at the college level. It presumes only a general knowledge of scientific concepts—introductory Chapters 1 and 2 provide adequate background to understand the issues in later chapters.

To better serve upper-level undergraduate and graduate students, or others with a more thorough background in marine or environmental sciences, recent findings from the primary scientific literature are included in the discussion; references to these sources are given at the end of each chapter for those interested in pursuing research findings to their original sources. The goal of this text is not to present the personal opinions of the author or indoctrinate the student with a specific conservation ethic, but to provide the information needed to formulate an educated opinion and, hopefully, to develop solutions to current problems associated with human interactions with the marine environment. Hopefully, students who study this text will become not only future scientists and environmental managers but also political leaders and participants in businesses dependent on marine resources, as well as consumers and users of ocean ecosystems.

Why a text focusing on the marine environment? Although knowledge and conservation methods applied to terrestrial and freshwater systems can often be used to solve marine environmental issues, in many ways conserving marine ecosystems presents unique problems. Many of these problems result from a reliance on the harvest of wild organisms from the seas. Whereas terrestrial food sources are largely agriculture based, marine organisms continue to be harvested primarily from wild populations, presenting unique conservation issues. Another reason that marine ecosystem studies present unique challenges is that the oceans present an environment that is largely foreign to humans. Despite the increased ability to access ocean environments through collection devices, scuba, or submersibles, most of the ocean remains unexplored. This presents a unique conservation dilemma—how to protect an ecosystem we haven't fully defined. A further distinctive influence on ocean protection is that many user groups desire and claim rights of access to the ocean and its resources. Most terrestrial lands are governed by private ownership or have their use tightly regulated through government oversight. However, much of the ocean is still considered, to varying degrees, available for common access, either to citizens of nations bordering the seas or to the global community. Coming to terms with overuse and loss of important marine habitats due to adherence to this philosophy is a phenomenon that conservation policies must address.

Regardless of the arguments for marine-focused text, there is a dilemma in defining the physical boundaries to

the marine environment that affects the text coverage. Technically, the marine environment might be considered to end abruptly at the interfaces between ocean waters and the adjacent atmosphere, sediments, and freshwaters. This is unrealistic, however, since many biological, chemical, and physical processes are continuous across these boundaries, and anthropogenic influences that originate beyond the ocean boundaries have a great impact on marine ecosystems. Thus, I have defined the marine environment broadly and included coverage of important anthropogenic effects that might originate beyond the marine environment and impact organisms that may crawl, swim, or fly across ocean boundaries. Coastal processes and influences are a major component of Chapter 3, and inputs from freshwater and terrestrial environments are important to Chapters 4 and 6. Interactions of the atmosphere and its pollutants with the marine environment are important to Chapters 1 and 7, and a section on the influences of climate change is included in each chapter. Many species defined as marine, discussed in Chapter 2, and endangered species, discussed in Chapter 9, spend a portion of their life beyond the oceans.

A further issue in determining coverage for a text focused on the marine environment is the international nature of the subject matter. Although much of the open ocean continues to be governed, at least in theory, as an area commonly accessible to all humans, a large fraction of the scientific research and most of the conservation decisions are made within the constraints of arbitrarily designated political boundaries. Scientifically, we cannot assume that even coastal waters and the matter and creatures they contain can be constrained within political boundaries. Socially and politically, we cannot expect that conservation decisions will be driven by the same ethics and legal systems around the globe. Thus, an attempt has been made to retain a broad international focus for this text. For issues with a national and regional focus, an attempt has been made to include examples from regions across the globe. Any focus on information originating from North American or English-speaking regions is a result of the availability of sources to the author.

Text Organization

Each chapter is organized into sections and subsections that separate topics by physical or biological classifications, habitat and ecosystem types, or categories of environmental and conservation issues. Topics that are pertinent to several chapters may be covered extensively in a single chapter to avoid repetition; in these cases, references are given in the readings to the chapter in which a pertinent

topic is covered. Text boxes are included in each chapter to focus on specific case studies, conservation concerns, recent controversies, or historical lessons. The Study Guide at the end of each chapter includes two types of exercises. Topics for Review contain questions addressing facts and concepts presented in the chapter. Conservation Exercises are designed to require synthesis of information, critical thinking, and development of opinions based on issues presented in the readings. Further Reading provides references used to develop the text or deemed useful for the student to gain further information. When a study author is mentioned by name in the text, a citation is given in the Further Reading section.

Chapters 1 and 2 present an overview of principles of environmental science, oceanography, and marine biology to provide a basic foundation. The material is focused on topics that are important to the understanding of environmental and conservation issues presented in later chapters. Specific conservation concerns and controversies related to the introductory topics are also presented.

Chapters 3 through 8 are organized by habitat and ecosystem type, progressing from the intertidal zone through near-shore ecosystems into the open ocean and deep sea. These chapters present a background description of habitats and ecosystem function, leading up to a discussion of important environmental and conservation issues specific to each ecosystem. Each chapter includes some broader topics that relate to multiple ecosystems. Text boxes present details of specific research studies, stories of conservation successes and failures, and current controversial issues.

Chapters 9 and 10 focus on two groups of organisms that are given special conservation attention. For marine endangered species, covered in Chapter 9, legal protections are broadly discussed and major animal groups are each discussed separately. An overview of the conservation status for each group is given, followed by specific examples of factors leading to endangerment and efforts for recovery and protection. Chapter 10 addresses conservation issues concerning cetaceans, the dolphins and whales. Sections are provided on major controversial issues of whale harvests, other sources of danger to cetaceans, and keeping cetaceans in captivity.

Chapter 11 addresses issues of marine fishery harvest, including the effects of excessive harvest on populations of fishes and other animals, the impacts of fishing on marine habitats and ecosystems, and efforts to conserve populations of harvested marine animals. Text boxes focus on recent scientific efforts to monitor harvested fish populations and give case histories concerning attempts to protect some highly valued and influential fishery species.

Chapter 12 provides an overview of major laws and agreements that address issues of marine conservation and environmental protection. Social and ethical paradigms are addressed as they relate to marine conservation issues. The discussion of laws and agreements is divided into sections on international and national laws for specific regions around the globe. Text boxes include a focus on U.S. fisheries laws and conflicts between international trade laws and conservation efforts.

Instructor Resources

A downloadable **PowerPoint® Image Bank** is available for qualified instructors. These files provide the illustrations, photographs, and tables (to which Jones & Bartlett Learning holds the copyright or has permission to reproduce digitally) inserted into PowerPoint slides. For more information, please contact your Jones & Bartlett sales representative or go to go.jblearning.com/beckman.

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Dan Beckman

Earth is a dynamic planet with a large body of water covering most of its surface. The physical and chemical processes that govern the behavior of the oceans are complex and dynamic. The physical and chemical processes that govern the behavior of the oceans are complex and dynamic. The physical and chemical processes that govern the behavior of the oceans are complex and dynamic.

2.1 Geological Oceanography

Geological oceanography is the study of the oceans and the earth's crust. It is a branch of geology that deals with the physical and chemical processes that govern the behavior of the oceans. It is a branch of geology that deals with the physical and chemical processes that govern the behavior of the oceans. It is a branch of geology that deals with the physical and chemical processes that govern the behavior of the oceans.

Seafloor Spreading

The seafloor is a dynamic surface with a diversity of physical features. It is a surface that is constantly changing and is a source of many of the physical and chemical processes that govern the behavior of the oceans.