THE OFFICIAL MAGAZINE OF THE OCEANOGRAPHY SOCIETY

Oceanography

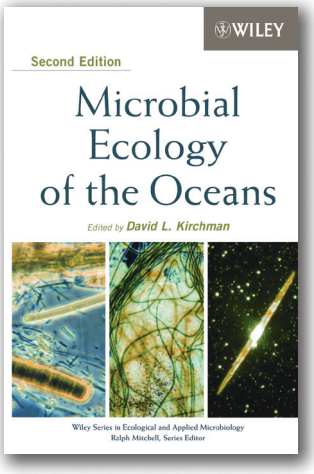
CITATION

Pomeroy, L.R. 2008. Review of *Microbial Ecology of the Oceans (Second Edition)*, edited by D.L. Kirchman. *Oceanography* 21(4):205–206, http://dx.doi.org/10.5670/oceanog.2008.26.

Microbial Ecology of the Oceans
Second Edition

David L. Kirchman, Editor, John Wiley & Sons, Inc., 2008, 593 pages, ISBN 047004344X, Hardcover, $100 US

REVIEWED BY LAWRENCE R. POMEROY



For much of the twentieth century, marine microbial ecology was considered to be a minor and relatively unimportant aspect of oceanography. A lack of appropriate methodology led microbiologists to believe that bacteria were not abundant or particularly active. That view began to change with the development of an improved method for counting marine bacteria (Hobbie et al., 1977), which showed them to be much more abundant than conventional methods had suggested. Research accelerated after publication of a method for measuring bacterial secondary production (Fuhrman and Azam, 1982) and of a sensitive method for measuring microbial respiration in the ocean (Williams and Jenkinson, 1982). Data gathered with these improved methods left no doubt that bacterial growth and respiration constituted a major carbon flux in the ocean.

Development of the field was then so rapid that textbooks and general overviews did not at first catch up. David Kirchman filled that void with the first edition of this book, published in 2000, consisting of a collection of critical reviews by experts in various aspects of marine microbial ecology. This second edition is a new and largely different book, with many chapters devoted to what is now the third stage in the evolution of marine microbial ecology—the genomics revolution. Many marine Bacteria, Archaea, eukaryotic algae, and Protozoa have never been seen or cultured although, as several chapters tell us, their DNA has been isolated, digitally assembled, and interpreted. We know many attributes of these unseen organisms that we would not learn by actually seeing them under a microscope.

Advances in microbial ecology continue to be technology dependent. Many obvious questions have remained unanswered until very recently because methods did not exist for research on very small organisms that are highly dispersed in the sea. Much of that deficiency has now been redressed by a growing number of marine microbiologists who are following the lead of the pioneers cited above. Both editions of Kirchman's book are about concepts and data, but methods, and remaining problems with them, are thoughtfully discussed. What makes the second edition such a different book is the wealth of new information and insights achieved through advancements that have occurred in just one decade. That progress is, in part, a result of the new methodology of genomics, which is a minor element in the first edition and a major one in the second, not only in the chapter devoted explicitly to genomics but in many others as well.

In the second edition, "microbial" takes on its true meaning, with more chapters now devoted not only to bacteria but also to the picoeukaryotes, both heterotrophic and autotrophic (i.e., protozoans and picophytoplankton). Several chapters discuss a potentially self-contained microbial food web with prokaryotic and eukaryotic autotrophs being consumed by heterotrophic protists, something that is conceptually significant for our understanding of the origins and fate of the ocean's photosynthesis. These developments are part of a more general shift from the mid-twentieth-century research focus on average rate processes of microbial communities to a focus on species, or phylotypes, and interactions at the species level. The authors of several chapters discuss interactions that we would call natural history if they were applied to macro-organisms, but at the microscopic level, questions of who eats whom include a focus on dissolved materials and biochemistry. The fact that we are capable of describing and understanding events at the level of marine microorganisms—not just at the birds and bees level—is perhaps one of the simplest and best metrics of the progress in microbial ecology.

Some of the chapters of the first edition have been revised for the second, but most are replaced, as Kirchman says in the preface, not because they are

obsolete but because little has changed in those areas, while new areas have developed. He therefore recommends owning and reading both editions. Indeed, that is necessary for a full overview of the field. Only in the first edition are there chapters on bacterial production, bacterial energetics and efficiency, food webs, top-down effects, and limiting inorganic nutrients.

Because textbooks dealing specifically with modern marine microbial ecology have not yet been published, Kirchman's first edition appears to have found some use in graduate courses in oceanography and marine biology. Recognizing that application, the writers have included boxes throughout the second edition in which terminology is defined and concepts explained in simple language. Those additions are only minimally helpful, and they do not make it a textbook. The book is highly detailed and somewhat redundant, owing to the many authors, and it is not organized in a helpful way for a student. Important subjects are covered only in the first edition, so the student needs to read most of the 1100 pages in the two books. Let us hope that the race is on to publish the first real textbook for marine microbial ecology. However, for the biological oceanographer, who already understands the jargon, this book and its predecessor are valuable, critical overviews of the state of marine microbial ecology. They are the best current analysis of a growing and important discipline.

Lawrence R. Pomeroy *(lpomeroy@uga.edu) is Alumni Foundation Professor Emeritus, Odum School of Ecology, University of Georgia, Athens, GA, USA.*

REFERENCES

Fuhrman, J.A., and F. Azam. 1982. Thymidine incorporation as a measure of hetrotrophic bacterioplankton production in marine surface waters: Evaluation and field results. *Marine Biology* 66:109–120.

Hobbie, J.E., R.J. Daley, and S. Jasper. 1977. Use of nuclepore filters for counting bacteria by fluorescent microscopy. *Applied and Environmental Microbiology* 33:1,225–1,228.

Williams, P.J. leB., and N.W. Jenkinson. 1982. A transportable microprocessor-controlled precise Winkler titrator suitable for field station and shipboard use. *Limnology and Oceanography* 27:576–584.

Oceans Past: Management Insights from the History of Marine Animal Populations

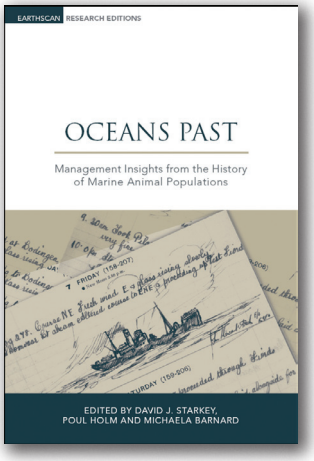
Edited by David J. Starkey, Poul Holm, and Michaela Barnard, Earthscan Research Editions, 2007, 223 pages, ISBN 978-1-84407-527-0, Hardcover, $127.00.

REVIEWED BY MICHAEL J. FOGARTY

History teaches us that men and nations behave wisely once they have exhausted all other alternatives.

—Abba Eban, Israeli Foreign Minister, London, 1970

If we could be transported back through time, would we recognize the structure of ocean ecosystems through the prism of their current state? What have we lost and to what degree might we be able to restore their potential? Historical narratives and descriptions of both natural history and the abundance of marine animals paint a vivid (if fragmented) picture of ocean ecosystems that extend back over millennia. Centuries-old chronicles of early explorers traveling to the New World include numerous tales of the untold bounty of the seas. Historians recognize, however, that it is necessary to treat such descriptions with some care. Were some written to attract investors in fishing and trading enterprises, others to attract settlers to uncharted lands? The History of Marine Animal Populations (HMAP) project of the Census of Marine Life (CoML) program seeks to complement anecdotal reports and historical records with careful analysis of sources



such as logbooks of whaling and fishing vessels, tithing or tax archives, and the paleo-ecological record to provide more quantitative estimates of marine animal populations of the past. To establish appropriate restoration goals, it is essential to determine the ocean's potential productivity. This analysis would permit establishment of realistic baselines for comparison with existing