BOOK REVIEWS

Limnol. Oceanogr., 46(1), 2001, 211

DE MORA, STEPHEN, SERGE DEMERS, AND MARIA VERNET [EDS.] 2000. **The effects of UV radiation in the marine environment.** Cambridge University Press. x + 324 p. US$80. ISBN 0-521-63218-8.

Irradiances of ultraviolet radiation (UVR), whether natural or enhanced as a result of anthropogenic ozone depletion, are an increasingly important part of our scientific lexicon. Long thought to be relatively unimportant, new information about the physics, chemistry, and photobiology of UVR now appear in the primary literature on a weekly basis, and as I look around my office, I see no fewer than 10 books and special reports on the biological effects of UVR, not to mention a number of reviews published in well-known journals. Although UVR studies appear from every latitude and habitat type, marine systems have been and continue to be a major focus. The goal of this book is to provide a ''state of the art'' overview of this burgeoning marine literature. The target audience is researchers and postgraduate students, but this book will also be an excellent source of information for those just starting on some aspect of UVR research, especially beginning graduate students. The material is up to date; the book is well laid out, written, and indexed, has very good graphics, and each chapter is followed by a comprehensive reference section.

The first chapter (Whitehead et al.) is a fine introduction to the problem, and the second chapter (Diaz et al.) provides ample background material on UVR physics and optics; both chapters are well written, but they overlap significantly in the area of atmospheric and water column physics and UVR optics. The third chapter (Neale) deals with the still underappreciated importance of action spectra. Of the many reviews available on this subject (most also written by Neale and coworkers) this one is the most complete because it takes full advantage of almost 10 yr of work on the methodology. For me, the most interesting chapter was the following one by Mopper and Kieber on the effects of UVR on carbon cycling; it brought me up to speed on a lot of work that has been going on in this field that I was not acquainted with. It also clearly presented the multiple biogeochemical and biological responses that are possible depending on the sources, photochemical fates, and utilization of dissolved organic matter. The next chapter on photochemical production of biological substrates (Kieber) could, it seems to me, have been incorporated into the previous one. Chapters 6 (Vincent and Neale) and 7 (Roy) provide complementary information on mechanisms of UVR damage and strategies to avoid or repair damage by UVR. I believe that the section on oxidative stress in Chapter 6 could have used more references. Moreover, although hydrogen peroxide is described as a ''powerful oxidant'' it is not; its potential for damage comes from its long lifetime and, therefore, its ability to be involved in metal-catalyzed (e.g., Fe^{+2}) Fenton-type reactions and, most importantly, its permeability through biological membranes. On the other hand, the treatment of protection from UVR (e.g., mycosporine-like amino acids) in Chapter 7 is excellent.

The next three chapters are focused on some of the most important groups of organisms in pelagic marine ecosystems: bacteria and viruses, phytoplankton, and larval fish and zooplankton. Chapter 8 (Jeffrey et al.) rightly concentrates on UVR-induced DNA damage in bacteria and viruses, as well as effects of UVR on their growth and biogeochemical cycling. Again, the discussion of DNA damage and repair has considerable overlap with Chapter 7. Chapter 9 (Vernet et al.) distills the voluminous literature of UVR effects on phytoplankton. The authors point out the difficulties that result from the range of experimental conditions under which assessments of UVR have been carried out but nevertheless do an admirable job of trying to reconcile and interpret the available data. They also do something that is not widely appreciated, viz. analyze the variability in the response to UVR of phytoplankton species from different latitudes to determine their ability to acclimate to UVR. Chapter 10 (Zagarese and Williamson) wanders furthest from the nominal central theme of ''marine environments''; although freshwater examples appear in a couple of other chapters, it is clear that many of the recent studies on UVR effects for both zooplankton and fish have been done in freshwater systems. More attention on this subject needs to be directed toward coastal and open ocean habitats, since UVR may affect mortality of marine fish, which is an essential and highly variable component of fisheries models that are used to determine total allowable catches. Finally, Chapter 11 (Mostajir et al.) addresses the implications of UVR on food web structure and carbon cycling. Assessing such effects is difficult, and few people are working on the problem, so it is not surprising that this chapter does little more than point out the need for more large-scale ecosystem or mesocosm studies to assess how UVR affects food web structure.

The most significant omission from the volume is some treatment of benthic systems. A chapter on attached marine macrophytes would certainly have been worthwhile because the literature on these important primary producers is rapidly growing. UVR effects on coral reefs have also received a lot of attention recently, but there is no shortage of reviews in this area. Despite its minor flaws, I highly recommend this superb volume to anyone with an interest in UVR in the marine environment. It is certainly the first book that I now reach for when UVR questions arise.

Michael P. Lesser

University of New Hampshire
Department of Zoology and Center for Marine Biology
Durham, New Hampshire 03824