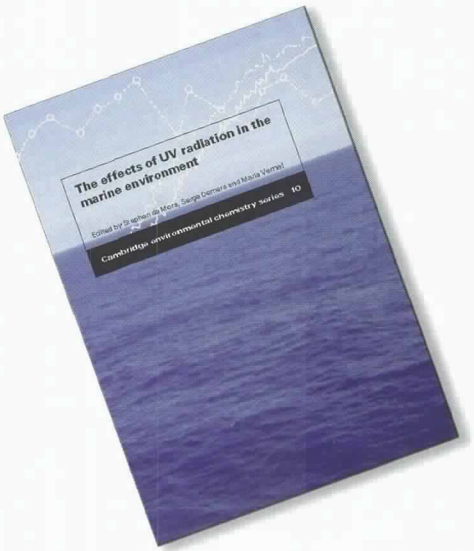
their specialty. Readers looking for an introduction to seagrasses will discover an invaluable guide to the biology of these truly remarkable organisms, as well as a useful introduction to the most important recent publications. This book will be of great value as a primary text in courses intended for advanced undergraduates and graduate students as well as a useful reference for practitioners in the field. The authors should be commended for producing a timely and thoroughly readable synthesis of seagrass biology.



The Effects of UV Radiation in the Marine Environment

Edited by:
Stephen de Mora, Serge Demers, and Maria Vernet
Cambridge University Press,
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Interest in the effects of ultraviolet (UV) radiation on the marine environment surged after the Antarctic ozone hole was discovered in the mid 1980s. Much of the ensuing research has focused on quantifying the potential influence of stratospheric ozone depletion on primary productivity, the survival of marine organisms, food web processes and biogeochemical cycling. Generally, this problem is approached by using experiments to assess the wavelength-dependent biological or photochemical effects of UV radiation (280 - 400 nm), especially UV-B (280 - 320 nm). Properly quantified results can be used in models to estimate the impacts of UV in nature and how they would differ in response to enhanced UV-B associated with ozone depletion.

More than a decade of active research has put the ozone problem in better perspective. Ultraviolet radiation is now recognized as a potent environmental factor that significantly influences marine chemistry, water clarity, primary productivity, and probably pelagic food web structure. Ozone depletion has an incremental effect. Exposures of aquatic organisms to UV are a function of location and time, modulated by clouds, colored dissolved organic matter, vertical mixing of plankton and depth of benthic organisms. Ecological responses to these time-varying exposures can be strongly influenced by acclimation and altered food web dynamics. Consequently, physical, chemical and biological interactions with UV can have a strong influence on the marine environment. Owing to the complexity of these interactions and their demonstrated importance, assessing the effects of ozone depletion is no longer the prime motivation for studying UV in the marine environment. Simply, the effects of UV must be understood to describe the workings of the ocean.

This book comes at a good time in the development of UV radiation as an important topic for marine research. The field is diverse enough to require a multidisciplinary overview, and small enough to review effectively in one book. Providing a balanced mix of background information, elaboration of key principles, and reviews of major research areas, this volume is well suited for the target audience of researchers and graduate students in photochemistry, photobiology and environmental sciences. Its eleven chapters provide an appropriate foundation for anyone beginning serious study of the topic.

The presentation is well organized, beginning with a general, but comprehensive introduction by Whitehead, de Mora and Demers. A review of atmospheric and hydrologic optics, natural variability in UV, and instrumentation follows (Díaz et al.). Chronically underappreciated problems associated with UV research are highlighted, including the limitations of many radiometers and the pitfalls of working with artificial sources of irradiance.

Accurate measurements or models of spectral irradiance are necessary, but not sufficient, for describing the relationships between UV exposures and biological effects in nature. Spectral weighing functions (SWFs) and exposure-response curves are fundamental requirements for extrapolating experimental results to the real world. Neale explains the concepts, methodology, and application of SWFs in a thorough treatment which includes clear descriptions of the underlying principles of SWFs and exposure-response curves, direct comparisons of different weighting functions for UV effects, and some new work reconciling kinetic models. The emphasis is on inhibition of photosynthesis by UV; kinetic models are also discussed in the chapter on zooplankton and fish (Zagarese and Williamson).

In eight remaining chapters, important research

topics are reviewed in varying levels of detail. An encyclopedic treatment of photochemistry and carbon cycling by Mopper and Kieber includes 58 references in one paragraph! The narrative may not flow, but this is a well organized and useful resource, especially because many journals now restrict the use of citations. Vincent and Neale employ a different approach, referring to a judicious selection of studies to describe mechanisms of UV damage. Behavioral, physiological and ecological strategies for minimizing this damage are reviewed by Roy. It is very helpful to find a broad range of information on damage and its avoidance in two adjoining chapters.

Emerging research topics are capably treated in chapters on photochemical production of biological substrates (Kieber) and effects on heterotrophic bacterioplankton and viruses (Jeffrey et al.). The impact of UV on zooplankton and fish has been studied for decades. Zagarese and Williamson review the topic in a well balanced presentation which includes lucid presentations of underlying principles.

Vernet is saddled with the formidable challenge of reviewing the large body of research on UV and marine phytoplankton. Major effects are described and generally accepted findings are identified in a chapter that also faithfully reports many conflicting or confusing results. Vernet concludes that extrapolation of results to natural environments (and, I add, the comparison of experimental results from different studies) are often compromised by inappropriate experimental designs, inadequate descriptions of UV during exposures, and a lack of environmentally relevant hypotheses. Many of these problems could be avoided if researchers carefully studied this book in preparation for their research on effects of UV in the marine environment.

Ultimately, we want to know the effects of variable UV on marine ecosystems. Mostajir et al. discuss this complex problem in the final chapter, showing how information from preceding pages can be applied to describe the effects of UV on pelagic food webs. Questions can also be addressed with experiments conducted in mesocosms. The authors discuss the approach and describe some results which suggest potential impacts of enhanced UV-B on food-web structure. Extrapolations to global biogeochemical cycles are speculative, but worthy of consideration as research proceeds.

The study of UV in the natural environment is complicated indeed. Like many aspects of oceanography, the topic is fundamentally interdisciplinary and effective research requires detailed knowledge in a broad range of fields from physics to cellular biology. This book provides the basics, and more. It is an excellent resource for researchers and graduate students and a useful reference for anyone wishing to describe or predict the effects of UV in the ocean, today and in response to a changing climate.

Books Undergoing Review:

Air-Sea Interaction: Laws and Mechanics
by G.T. Csanady
Cambridge University Press, 0-521-79680-6, 239 pp.

Muddy Coast Dynamics and Resource Management
B.W. Flemming, M.T. Delafontaine & G. Liebezeit (Editors)
Elsevier, 0444504648, 294 pp.

Tsunami: The Underrated Hazard
by Edward Bryant
Cambridge University Press, 0-521-77799-X, 320 pp.