

Volume preface

The surge in the systematic study of UV effects on aquatic habitats is contemporary with the discovery of the ozone hole in the 1980s. Since then, and for the last two decades, the number of publications on UV related issues has grown virtually exponentially. Paralleling the explosive development of this new “field”, a number of reviews have attempted to summarize the available knowledge in the primary literature. These works have evolved from environmental agencies’ reports to symposia volumes to multi-authored edited books, many of which are excellent, some of which are reasonably comprehensive, and a few of which are quite recent. Thus, as soon as we were offered the opportunity of producing a new book on UV effects on aquatic ecosystems, we wondered how a new book on this subject could provide new insights or a different perspective, and perhaps the stimulus or inspiration for future research. In this book, we have attempted to bridge the gap between the environmental studies of UVR effects and the broader, traditional fields of ecology, oceanography and limnology. Our purpose has been to provide evidence to persuade a general ecologist that UV driven processes are relevant to aquatic ecosystems. But, at the same time, we wanted to adopt the point of view that UV is only one of several important ecological processes operating synchronously in the natural environment. If we have succeeded, the message from this book should be that the search for environmental UV effects must be framed within a wider ecological context.

What’s in the book

The book is divided into five sections, which are intended to cover the most salient aspects of UV research. The introductory chapter provides an overview of the role of UVR in aquatic systems with a strong emphasis on the interaction between UVR and DOM. This interaction will be a recurrent subject in subsequent chapters, and reflects the contemporary perception of UV researchers about the key role played by DOM in controlling UV optics, and directly or indirectly regulating chemical and biological processes.

The Physics section provides information and discussions on global UVR climatology at the Earth's surface level and the factors controlling the transmittance of UVR through the atmosphere (Chapter 2), and the penetration into the water column (Chapter 3). The last chapter within this section (Chapter 4) introduces basic notions of mixing and advection and outlines the implications of vertical water motion for photochemical and photobiological processes.

The four chapters within the Chemistry section discuss the effects of UVR on biogeochemical cycles of various elements (Chapter 5), the photochemistry of DOM (Chapter 6), the photo-activated toxicity of several natural and anthropogenic substances (Chapter 7) and the environmental implications of photoinduced formation of reactive oxygen species (Chapter 8). Once again, the central role of DOM emerges as a unifying theme.

The fourth section focuses on individual and sub-individual effects and responses. The first chapter within this section (Chapter 9) reviews the effects of UVR on DNA, which has long been identified as one of the primary targets of UVR in biological systems. It is followed by a discussion of the main physiological photoprotective mechanisms in aquatic organisms (Chapter 10). Chapter 11 reviews the available literature on UVR effects on autotrophs, while Chapters 12 and 13 present two different and complementary perspectives on the effects of UVR on heterotrophs. This section ends with an extensive review on the role of sensory systems and behavioral responses to UVR (Chapter 14).

Three chapters within the last section address the effects of UVR from the community and ecosystem perspective that has been anticipated in the introductory section. Chapter 15 provides a thorough review of the effects of UVR on species interactions, including predation, competition, parasitism and diseases. Chapter 16 discusses the methods for reconstructing the radiation history of aquatic ecosystems and presents evidence for different UVR paleoclimates. Chapter 17 speculates on potential future UVR scenarios in a world that is experiencing several climatic changes from regional acidification to global warming and the also global depletion of stratospheric ozone.

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