## The effects of UV radiation in the marine environment

Decreasing concentrations of ozone in the stratosphere radically influence the effects of UV radiation on the environment. This book provides a comprehensive review of UV radiation effects specifically in the marine environment. A multidisciplinary approach is adopted to discuss all aspects from physical, chemical and biological perspectives.

The book begins by describing the attenuation of UV radiation in the atmosphere and seawater, outlining the photochemical reactions involved and highlighting the role that such chemistry can play in influencing the biogeochemical cycling of various elements. The deleterious consequences of such radiation on organisms are discussed, from viruses and bacteria through phytoplankton and zooplankton to fish and mammals. The strategies adopted by these organisms to mitigate such harmful repercussions and a synthesis of the UV-induced response at a community level are also considered.

The book is aimed at researchers and graduate students in photobiology, photochemistry and environmental science. It will also be useful as a supplementary text for courses in oceanography, climatology and ecology.

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# The effects of UV radiation in the marine environment

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# Preface

Insofar as UV radiation (UVR) is a natural component of solar radiation, the marine environment has always been exposed to UVR. However, anthropogenic influences via stratospheric ozone depletion have caused an increase in the UVR flux to the earth's surface in recent years. In this way, the effects of enhanced UVR on the marine environment can be considered to be a new problem. Moreover, the relative change in the UVR flux is greatest in the polar regions, which are most susceptible to 'ozone hole' formation in the spring, arguably a very sensitive time for marine organisms. Recognition of the Antarctic ozone hole initially prompted considerable research aimed at phytoplankton, owing to their importance in primary production. Subsequent investigations were extended to consider both the microbial loop and higher trophic levels. Elucidating responses at the ecosystem level remains the ongoing challenge in this field.

This book is aimed at researchers and the postgraduate student market, providing a state of the art review of UVR effects in the marine environment. A multidisciplinary approach is adopted such that basic properties of the relevant physics, chemistry and biology are included. The fate and effects of UVR are treated as a continuum, with the underlying intent to try to follow the pathway and fate of a UV photon. The progression considers firstly optical properties and the attenuation of UVR in the atmosphere and seawater. Then the wavelength dependence of absorption by both molecules and organisms is explained. Next, photochemical reactions are described, highlighting the role that such chemistry can play in influencing the biogeochemical cycling of several elements. Two chapters discuss the deleterious consequences of such radiation and the strategies adopted by organisms to mitigate harmful repercussions. Thereafter, the text considers the effects of UVR on organisms, following the stepwise progression through the trophic levels

from viruses and bacteria through phytoplankton and zooplankton to fish. Finally, a brief synthesis of the UV-induced response at a community level is presented.

This book has evolved from a workshop entitled 'The Effects of UV Radiation on Various Ecosystems at Different Latitudes' held in Ensenada, Mexico, in September 1996. Many of the authors here were invited speakers at this meeting. Financial support for the workshop from the Inter-American Institute for Global Change is gratefully acknowledged. Finally, we wish to thank the numerous referees for commenting on individual chapters.

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