# Preface

In addition to presenting researchers with fascinating material with which to study microbial cell processes, cell structure and communication, molecular evolution and ecology, cyanobacteria are impacting widely on the daily activities, practical needs and lives of the general public. The ability of many terrestrial and especially of aquatic cyanobacteria to produce mass populations (blooms, scums and mats), including by strikingly pigmented and odorous species in natural and controlled environments, readily brings these microbes to the direct attention of the general public. Perceptions of cyanobacterial mass populations range from 'nuisance' to 'harmful', since public awareness is also driven by the occurrence of poisonings to domestic pets, farm livestock and wildlife and by occasional human illnesses, from mild to serious, after contact with waterborne cyanobacteria. At official level, in public and private institutions, cyanobacteria are being increasingly recognised as agents which should be monitored and managed to avoid or reduce the likelihood of their adverse impacts on water resources and human and animal health although gaps remain.

Institutional recognition and obligations range from international (e.g. World Health Organization, UNESCO, European Union), though national authorities, to regional and local organisations, with responsibilities to uphold international and national guidelines, and in some cases national legislation, for the risk management of water resources containing or prone to supporting cyanobacteria. The range of institutions involved, or which need to be involved, in cyanobacterial risk management reflects the diverse impacts of cyanobacteria and their toxins (cyanotoxins) on the direct and indirect uses of water resources which can contain cyanobacteria. Relevant sectors include public health, drinking water supply, environmental protection and conservation, aquaculture and fisheries, agriculture and, not least, recreation and tourism. However, although the risk management of cyanobacteria and cyanotoxins is recognised and implemented at multiple levels, the extent of awareness and experience at national, regional and local level varies widely. This variation exists amongst managers and their field operatives and laboratory personnel.

The need for increased awareness raising across Europe and neighbouring countries for the dissemination of knowledge and experience and sharing of best practices, for the risk management of cyanobacteria and cyanotoxins, has been recognised and supported by the COST Action ES1105 – 'CYANOCOST: Cyanobacterial blooms and toxins in water resources: Occurrence, impacts and management', running from 2012 to 2016. The Action involves 32 countries, reflecting the extent of cyanobacterial mass population developments across Europe and beyond. Recent findings of increases in the geographical distribution, population sizes and seasonal duration of annual mass populations and of invasive species of cyanobacteria in European waters (aspects of climate change) attest to the timeliness of CYANOCOST and of this handbook.

In addition to dissemination, technology and skills sharing and validation, the effective sampling and identification and quantification of cyanobacteria and cyanotoxins closely follow behind primary research. Virtually all areas of cyanobacterial monitoring and cyanotoxin analysis continue to be researched, for example, as new instrumentation becomes available (both high-technology laboratory equipment and ease-of-use methods), molecular biology methods are applied in the field, cyanobacterial identification and nomenclature undergo change, and further

cyanotoxins are recognised. This handbook provides reviews on growth areas in this research in addition to surveying the more established aspects of cyanobacterial ecology and monitoring and of cyanotoxins and their analysis. For example, after an earlier period of decline in the use of bioassays, when physico-chemical methods for cyanotoxin analysis became more widely available, new bioassays are again being seen as a valuable asset for cyanobacterial toxicity assessment where toxicity cannot be adequately accounted for by the analysis for known cyanotoxins. Twenty-nine standard operating procedures are provided which include detailed instructions to enable the methods to be used for the environmental sampling, examination and quantification of cyanobacteria, the known cyanotoxins, and for toxicity assessment by bioassay. Whilst useable, reliable, repeatable and robust methods are required, the value of such field and laboratory monitoring and analysis in guiding risk management also depends, as discussed here, upon the suitable choice of methods and on the effective reporting and interpretation of the results. We hope that this handbook will contribute to the effective widening of cyanobacterial and cyanotoxin risk management for the welfare of environmental resources and protection of human health.

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