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BOOK REVIEWS

Ansari, Abid.A.; Gill, Sarvajeet Singh; Lanza, Guy.R. and Rast, W. (Editors) 2011. Eutrophication: Causes, Consequences and Control. Springer Science+Business Media B.V. ISBN: 978-90-481-9624-1. Price: € 194.99 xiii + 394 pages.

The pace of various human impacts on our environment has increased rapidly during the past century or so and its consequences are assuming serious dimensions threatening the biodiversity, nature's functioning and in turn, the human well being. It is often not well appreciated that all anthropogenic activities, whether on land or in water, directly or indirectly impinge upon the world's aquatic ecosystems – from ponds and streams to large lakes, rivers and the oceans. Sediments, nutrients and a wide range of organic and inorganic pollutants, many of them non-degradable, move from land to water and end up in lakes and oceans. Among several major problems, the most common and most important is unequivocally the eutrophication which usually refers to the process of nutrient enrichment of water bodies causing the production of algal blooms accompanied by oxygen depletion in their deeper layers, and the consequents effects on water quality and biota (especially fisheries). Over the past century since the term 'eutrophic' was first used (Weber 1907) and later applied to the lakes (Thienemann 1918), and particularly since the process was shown to be caused by domestic wastewaters (Hasler 1947), eutrophication of lakes, reservoirs and oceans has received increasingly greater attention in all parts of the world. The causes, consequences and mitigation measures have been investigated and discussed in great many details that have been published in numerous journals, books and reports.

The book under review brings together a collection of articles which offer a glimpse of eutrophication research and management approaches in tropical to temperate freshwater and marine ecosystems. The book includes 19 chapters contributed by from 46 scientists from 17 countries. Most of the contributions deal with issues concerning eutrophication in fresh water lakes and reservoirs except one on wetlands, one on Baltic sea and three on estuarine systems. Most of the contributions refer to climate or climate change in one or the other context. The opening chapter by Dokulil and Teubner provides a brief overview of the eutrophication in relation to climate change. This is followed by a detailed account of the problems of eutrophication in the Baltic Sea, focusing especially on the measures for its control, by Hakanson and Bryhn who have published extensively on the subject. The next chapter introduces the reader to the issues of water quality in the King Abdullah Canal, Jordan where the formation of trihalomethanes is a major problem. This problem is certainly not confined to the waters of arid regions as the title seems to indicate. Beklioglu et al. (including Jeppesen and Sondergard) provide a very useful comparison of eutrophication processes and the restoration in shallow lakes from cold temperate to warm Mediterranean and subtropical regions. The chapter by Persic et al. highlights the importance of hydrological connectivity to the trophic state and water quality in lake on the floodplain of River Danube in Croatia. Staying in the Mediterranean region, Naselli-Flores describes an interesting case of eutrophication in Sicilian reservoirs driven by large water level changes (caused by summer withdrawal of water) and consequent internal loading of nutrients and instability of thermal stratification. He also explains how the hydrological management of the reservoirs based on limnological understanding (maintaining summer stratification and lowered water level changes) has helped mitigate the problem of toxic cyanobacterial blooms.

In the only contribution on freshwater wetlands, Sanchez Carrillo et al. discuss the effects of nutrient enrichment on biological responses, biogeochemical processes and ecosystem functioning. They point out that the hydroperiod controls nutrient cycling through soil redox transformations and hence, water level changes are important factors in eutrophication. They further show the importance of biomanipulating fish stocks in accordance with the water level changes.

Three chapters cover the impacts of eutrophication in estuarine environments. Dolbeth et al. describe in detail a case study of the Mondego estuary in Portugal. They discuss the dynamics of seagrass, macroalgal and benthic faunal communities in relation to eutrophication and following two hydrological interventions (diversion of nutrient rich waters from entering the estuary and a reduction in the water residence time) to mitigate the impacts of pollution and eutrophication. The Mondego estuary (together with Mira estuary) is also the subject of another chapter in which Castro and Freitas evaluate the relative utility of macrophytes and chemical variables in the assessment of eutrophication level, and call for the development of suitable indicators for estuarine systems. Dorgham presents in detail the water quality, particularly N and P changes over long periods, phytoplankton blooms and their production, changes in benthic communities and fish mortality in five coastal lagoonal systems of Egypt.

Jiang et al. examine the trophic status of major ntural lakes in China and discuss the drivers of eutrophication in newly build reservoirs such as the Three Gorges and Laohutan. The effects of eutrophication are invariably modified by a variety of other stressors of which heavy metal are an important variable. Gagneten examines the combined effect of heavy metal contamination and eutrophication on zooplankton in a field study on streams in Argentina and discusses its likely consequences for food webs.

In between these interesting case studies are included two chapters by Ansari et al.. In one, they attempt a sketchy review of eutrophication problems threatening the aquatic ecosystems and also discuss the remediation measures, largely centered around biological

interventions. In the other, they review studies on various aspects of aquatic plants in eutrophic water bodies.

Four chapters, towards the end of the book, are devoted mainly to mitigation of eutrophic water bodies, concentrating on the role of macrophytes. Dokulil et al provide a brief case study of a shallow urban lake, the Old Danube in Vienna, and discuss the growth of macrophytes in the context of the theory of alternative stable states. Landesman et al. present a brief account, based mostly on relatively old studies, of nutrient removal by duckweeds and discuss in some detail the utilization of duckweeds. Babourina and Rengel from Australia start with the premise that increased nitrogen concentration is one of important causes of eutrophication. They discuss NH_4 vs NO_3 uptake by different macrophytes, N versus P limitation, and the role of rooted submerged plants in removing nitrogen from fresh waters. Sharma et al. present a 3-year whole lake experimental study involving the removal of top predator fish (northern pike, *Esox lucius*) in Lake Årungen (Norway) and report the potential of such large scale biomanipulation for improving water quality and reduction in the contaminant levels of other fish.

The last chapter by Lanza takes us to the Mekong river basin in Laos and summarises significant studies on water quality, sediments and habitat ecology, conducted during early 1970, in relation to the aquatic snail vectors of *Schistosoma mekongi*. He then links up these studies with the problem of eutrophication in the newly built reservoirs for hydropower projects to show their potential for the spread of aquatic vector-borne diseases.

The book attempts to cover a quite broad canvas as the 19 chapters highlight the magnitude of the problem, the kind of studies on responses of divergent ecosystems to nutrient enrichment, and mitigation efforts in different parts of the world. The chapters differ greatly in their objectives, treatment of the subject and style of presentation. However, there has been either no or very little effort towards editing the contributions. The editors have not tried to even arrange the chapters in some sequence or group them into specific themes. I doubt if the chapters were read through or reviewed by any other person. A couple of errors may be noted here by way of examples: on p. 171 (abstract) ‘eutrophication is an importunate problem’; Table 16.2 on p. 326 lists information on 13 lakes whereas the caption mention 26 lakes; on p. 385 (left column) the reference to Prathumratna et al. is placed in the middle of the text. Several chapters include very basic and generic material that is repeated in some form. Such parts of the text should have been edited and condensed, if necessary to place them in context. The two chapters contributed by the first-named editor and his colleagues are very weak, lack a clear focus and are poorly organised. The authors keep on moving swiftly and back and forth through a maze of references leaving the reader confused. One would expect the editors to provide a brief introduction to the scope and objectives of the book and then provide a general synthesis distilled from the contributions in the book, along with some conclusions and suggestions on the directions to go further. The only redeeming feature of this book are the contributions by some of the well known scientists in the field. The book will be of interest to the libraries which do not have ready access to the past literature on eutrophication.

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