

The Handbook of Environmental Chemistry

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Egyptian Coastal Lakes and Wetlands: Part I

Characteristics and Hydrodynamics

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Aims and Scope

Since 1980, *The Handbook of Environmental Chemistry* has provided sound and solid knowledge about environmental topics from a chemical perspective. Presenting a wide spectrum of viewpoints and approaches, the series now covers topics such as local and global changes of natural environment and climate; anthropogenic impact on the environment; water, air and soil pollution; remediation and waste characterization; environmental contaminants; biogeochemistry; geoecology; chemical reactions and processes; chemical and biological transformations as well as physical transport of chemicals in the environment; or environmental modeling. A particular focus of the series lies on methodological advances in environmental analytical chemistry.

Series Preface

With remarkable vision, Prof. Otto Hutzinger initiated *The Handbook of Environmental Chemistry* in 1980 and became the founding Editor-in-Chief. At that time, environmental chemistry was an emerging field, aiming at a complete description of the Earth's environment, encompassing the physical, chemical, biological, and geological transformations of chemical substances occurring on a local as well as a global scale. Environmental chemistry was intended to provide an account of the impact of man's activities on the natural environment by describing observed changes.

While a considerable amount of knowledge has been accumulated over the last three decades, as reflected in the more than 70 volumes of *The Handbook of Environmental Chemistry*, there are still many scientific and policy challenges ahead due to the complexity and interdisciplinary nature of the field. The series will therefore continue to provide compilations of current knowledge. Contributions are written by leading experts with practical experience in their fields. *The Handbook of Environmental Chemistry* grows with the increases in our scientific understanding, and provides a valuable source not only for scientists but also for environmental managers and decision-makers. Today, the series covers a broad range of environmental topics from a chemical perspective, including methodological advances in environmental analytical chemistry.

In recent years, there has been a growing tendency to include subject matter of societal relevance in the broad view of environmental chemistry. Topics include life cycle analysis, environmental management, sustainable development, and socio-economic, legal and even political problems, among others. While these topics are of great importance for the development and acceptance of *The Handbook of Environmental Chemistry*, the publisher and Editors-in-Chief have decided to keep the handbook essentially a source of information on "hard sciences" with a particular emphasis on chemistry, but also covering biology, geology, hydrology and engineering as applied to environmental sciences.

The volumes of the series are written at an advanced level, addressing the needs of both researchers and graduate students, as well as of people outside the field of

“pure” chemistry, including those in industry, business, government, research establishments, and public interest groups. It would be very satisfying to see these volumes used as a basis for graduate courses in environmental chemistry. With its high standards of scientific quality and clarity, *The Handbook of Environmental Chemistry* provides a solid basis from which scientists can share their knowledge on the different aspects of environmental problems, presenting a wide spectrum of viewpoints and approaches.

The Handbook of Environmental Chemistry is available both in print and online via www.springerlink.com/content/110354/. Articles are published online as soon as they have been approved for publication. Authors, Volume Editors and Editors-in-Chief are rewarded by the broad acceptance of *The Handbook of Environmental Chemistry* by the scientific community, from whom suggestions for new topics to the Editors-in-Chief are always very welcome.

Damià Barceló
Andrey G. Kostianoy
Editors-in-Chief

Preface

Egyptian northern coastal lakes (Mariout or Mariut, Edku or Edko, Burullus or Borollus, and Manzala and Bardawil) could be a source of wealth for Egypt if the Egyptian and the concerning authorities intend, plan, and implement the necessary measures to keep the lakes sustainable. Therefore, this book *The Egyptian Coastal Lakes* in two volumes is produced by the Egyptian researchers and scientists to help and support those who are interested in these lakes. This volume consists of 6 parts divided into 13 chapters written by 10 authors and focuses on the characteristics and hydrodynamics of these lakes.

The introduction of this volume I is presented in Part I which contains the chapter “An Overview of the Egyptian Northern Coastal Lakes”. This chapter presents basic information on the five northern coastal lakes, their origin, description, and the current development activities that were derived from problems from which the lakes are suffering.

Part II of this volume consists of two chapters presenting the opportunities, challenges, and adaptive management of the lakes. The chapter titled “Land Use in Egypt’s Coastal Lakes: Opportunities and Challenges” shows that the lakes are promising zones in Egypt and could be of great importance to the Egyptian economy. It presents in some detail the challenges facing these lakes including shrinking, pollution, and climate change and how to face these challenges. In the chapter titled “Adaptive Management Zones of Egyptian Coastal Lakes”, the authors present the classification and evaluation of lakes. Also, the challenges facing the sustainable development of these lakes were identified. They presented how the adaptive management approach would facilitate the investigation and classification of the Egypt’s lakes and depressions.

Part III of this volume consists of three chapters dealing with the physical and chemical properties of the five lakes with a focus on Burullus wetland and Manzala. The first chapter “Sediment Contaminants in Northern Egyptian Coastal Lakes” presents the contaminations of coastal lakes due to contaminated water feeding the lakes. On the other hand, the variation of the physical and chemical parameters of the five lakes is presented and discussed in the chapter “Physical and Chemical

Properties of Egypt's Coastal Wetlands; Burullus Wetland as a Case Study". In the chapter "Lake Manzala Characteristics and Main Challenges", the authors present an extensive background of the Lake Manzala including physical, chemical, and biological characteristics to date and, in addition, the main challenges facing the lake.

Part IV contains two chapters dealing with phytoplankton and macrobenthos in coastal lakes. The chapter titled "Phytoplankton Ecology Along the Egyptian Northern Lakes: Status, Pressures and Impacts" provides how phytoplankton characteristics differ from one lake to another considering the water quality and the seasonal and spatial differences in the quantitative and qualitative composition of the phytoplankton communities at each lake. The relevance of phytoplankton data and information to the assessment process of lakes status is addressed. The chapter titled "Macrobenthos Diversity of Egypt's Coastal Wetlands" presents how the macrobenthos are affected by the lakes environment and by seasonal variation. Two macrobenthos indicators are discussed, namely, eutrophication-indicator species and salinity-indicator species. Also, they present the biodiversity of the macrobenthos in the lakes with an emphasis on Lake Bardawil macrobenthos.

Part V consists of four chapters dealing with the hydrodynamics modelling of the coastal lakes of Egypt. The chapter "Lakes and Their Hydrodynamics" presents the seven main different formation processes of lakes in its first part, as tectonic activity, volcanic activity, glacial activity, fluvial action, aeolic action, and anthropogenic and marine action. In the second part of the chapter, the authors focus on the hydrodynamics within lakes, and they provide information on main hydrodynamic processes in lakes such as inflows and outflows, wind shear, vertical circulation, thermal stratification, and gyres and seiches. In the chapter titled "Basics of Lake Modelling with Applications", the authors present a review of the hydrodynamics modelling studies of coastal lakes, with an emphasis on Egyptian coastal lakes with applications in water quality management and sediment transport scenarios. A summary of the available hydrodynamic models categorized and an evaluation for their suitability for hydrodynamic modelling the Egyptian coastal lakes are provided. The chapter titled "Numerical Simulation of Lake Mariout, Egypt" and the chapter titled "A Three-Dimensional Circulation Model of Lake Bardawil, Egypt" present the latest findings of the modelling studies for Lake Mariout and Lake Bardawil, respectively. The results of these studies are published in this volume for the first time.

Part VI summarizes the key points and the conclusions of the volume and presents a set of recommendations for future studies and to help the decision- and policymakers to take the necessary measures to develop, restore the lakes ecology, and keep them sustainable to support the Egyptian economy.

The editors would like to express their special thanks to all those who contributed in one way or another to make this high-quality volume a real source of knowledge and with the latest findings in the field summarized to support post-graduate students, researchers, scientist, and decision/policymakers in Egypt and everywhere who are interested in the coastal lakes. Particular and special appreciation and thanks are due to all the authors who had contributed to this volume.

Without their patience and effort in writing and revising the different versions to satisfy the high-quality standards of Springer, it would not have been possible to produce this volume and make it a reality. Acknowledgements must be extended to include all members of the Springer team who had worked hard for a long time to produce this unique volume.

The volume editor would be happy to receive any comments to improve future editions. Comments, feedback, suggestions for improvement, or new chapters for next editions are welcome and should be sent directly to the volume editors.

Zagazig, Egypt
Tanta, Egypt
Hamilton, ON, Canada
14 April 2018

Abdelazim M. Negm
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