

## 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/](http://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

Prof. Andrey Kostianoy, one of the two editors-in-chief of the book series *The Handbook of Environmental Chemistry* (HEC), published by Springer, made a recommendation to publish a book volume on the mega deltas when we met at the International Water Technology Conference in 2015. I thought it a good idea to start with a volume on the Nile Delta, Egypt, as this being one of the Earth's great mega deltas. I discussed the prospective book with potential authors, specifically its usefulness to decision-makers, researchers, and graduate students who are interested in mega deltas in general and the Nile Delta in particular, and several expressed a desire to contribute. Major concerns motivating the authors and the editor to write this book are the problems and challenges facing the Nile Delta concerning the shortage of fresh water and those arising once the reservoir of the Grand Ethiopian Renaissance Dam (GERD) starts filling and GERD enters into full operation.

This book volume consists of 19 chapters in 6 parts, and has been written by 27 distinguished researchers and scientists from different institutions, stakeholders, and research centers with major concerns regarding water resources, agriculture, land and soil, applications of remote sensing and geographic information systems (GISs), lakes, fish and fisheries, and the environment. Part I is an introduction and contains two chapters. The chapter "Nile Delta Biography: Challenges and Opportunities" presents a comprehensive and concise summary of recent research related to challenges in Nile Delta regions and the possible opportunities to improve its productivity. In the chapter "Ancient Water Supply System in Tall Tanis, Archaeological Area Northeastern Nile Delta Region, Port Said, Egypt," a description of the ancient water harvesting system, including water storage, transport, and pumping systems that were used in the Nile Delta, is presented.

Part II of the book deals with groundwater in the Delta and the areas surrounding it. It consisted of five chapters. The chapter "Nile and Groundwater Interaction in the Western Nile Delta, Egypt" presents the results of analyzing the collected samples from a total of 108 wells varying in depth from 27.5 m to 120 m located in the western Nile Delta to identify the physico-chemical parameters and chemical compositions of the groundwater and to obtain additional information on the

possible interaction with the Nile water. The hydrochemistry of major ions ( $K^+$ ,  $Na^+$ ,  $Mg^{2+}$ ,  $Ca^{2+}$ ,  $Cl^-$ ,  $SO_4^{2-}$ ,  $HCO_3^-$ ,  $CO_3^{2-}$ ) together with trace elements (Fe, Mn, Zn, Pb, Cd, Cr, Cu, Ni) has been used to constrain the hydrochemical characteristics of groundwater, western Nile Delta aquifers. The chapter “Mapping of Groundwater in Egypt Using RS/GIS: Case Studies, Areas Surrounding Nile Valley and Its Delta” presents a review of groundwater mapping in Egypt using remotely sensed surface indicators of groundwater with case studies from the Nile Valley and its Delta. In addition, the usage of GIS in groundwater mapping is highlighted. In the chapter “GIS-Based Spatial Distribution of Groundwater Quality in the Western Nile Delta, Egypt,” the authors present a multivariate statistical analysis of groundwater quality for the western Nile Delta (ND) aquifer carried out to investigate the factors controlling the groundwater quality using the spatial tool of ArcGIS for mapping the water quality in the western Nile Delta. The suitability of the groundwater of this area for irrigation and drinking is investigated and the spatial distribution of groundwater suitability for both uses are presented. The fourth chapter of Part II entitled “Modeling of Fertilizer Transport Through Soil, Case Study: Nile Delta” describes the aquifer systems and the principles of contaminated groundwater modeling, and the various modeling tools/codes are also discussed. An application using MODFLOW and MT3DMS to simulate three-dimensional groundwater flow and  $NO_3^-$  transportation processes of an area located in the central region of the Nile Delta aquifer is presented as a case study. The introductory sections of this chapter (geography, climate, and geology) were moved and presented in the first chapter of the book. Part II ends with the chapter “Groundwater Degradation and Remediation in the Nile Delta Aquifer.” The chapter aims to identify problems, knowledge gaps, and needs that are deemed important to improving groundwater monitoring, modeling, and remediation in the Nile Delta.

Part III consists of four chapters dealing with Nile Delta land and soil status, remediation of drainage water, and typical farm irrigation management in the Nile Delta. The chapter “Land Degradation in the Nile Delta” describes the various forms of land degradation, including salinity, water logging, sea water intrusion, pollution, nutrient depletion, and population encroachment. The author also discusses the main sources of hazardous salts in Nile Delta soils, including irrigation water (reused drainage water), shallow water table and water logging, and sea water intrusion of the water table and surface soils. The “Management of Salt-Affected Soils in the Nile Delta” is presented in next chapter. The chapter “Remediation of Agricultural Drainage Water for Sustainable Reuse” discusses the agricultural drainage reuse activities in Egypt as a non-conventional water resource, with a special focus on the Nile Delta. The last chapter of Part III entitled “On-Farm Water Management in the Nile Delta” reviews irrigation development in the Nile Delta followed by an assessment of the on-farm irrigation performance and economic aspects in irrigation management. A set of scenarios for improving the agricultural economic efficiency and sustainability of water use while respecting cultural, hydrological, environmental, and institutional constraints on urban and environmental uses are tested for a study area in the Nile Delta.

Part IV of the book consists of five chapters dealing with the Nile Delta coastal zone and its lakes. The chapter “Sediment and Water Quality of the Nile Delta Estuaries” discusses water and sediments quality for Rosetta and Damietta estuaries and the water quality of the Nile Delta coastal lakes (Marioute, Manzala, Burullus, and Edku). The factors affecting water quality deterioration are also presented and discussed. The chapter “Assessment of Nile Delta Coastal Zone Using Remote Sensing” presents the results of using satellite images for the years 1984, 1990, 2005, and 2014 to detect changes in land cover and to examine shorelines, thereby identifying erosion and accretion areas, around the Rosetta promontory. The chapter entitled “Protection Methods Against Sea-Level Rise Caused by Climatic Change: Case Study of the Nile Delta Coastal Zones” presents a state-of-the-art of the methods and strategies that can be used to cope with the expected sea-level rises in different countries. The chapter ends by examining the current situation in Egypt and the vulnerability of the Nile Delta coastal zone to sea-level rise. The next chapter, “Estimation of Bathymetry Using High-resolution Satellite Imagery: Case Study El-Burullus Lake, Northern Nile Delta,” discusses the different techniques for estimating the lake’s bathymetry using remote sensing with regard to Lake El-Burullus. Then comes the chapter “Sustainability of Water Bodies of Northern Egyptian Lakes: Case Studies, Burullus and Manzalla Lakes” which discusses the detection of changes occurring in the water bodies of the two lakes using remote sensing, based on satellite images from 1990 to 2015.

Part V of the book consists of two chapters dealing with fishing ports, fish, and fisheries. The chapter “Assessment of Egyptian Fishing Ports Along the Coasts of the Nile Delta” presents the results from field visit/surveys and questionnaires completed in the coastal fishing ports along the Northern coast. The next chapter “Fish and Fisheries in the Nile Delta” describes fish and fisheries, fishing methods, and aquaculture in the Nile Delta Lakes. The challenges facing Nile Delta fisheries and suggested management plans are also highlighted.

Part VI contains only “The Nile Delta: Update, Conclusions, and Recommendations” which closes the book volume by the main conclusions and recommendations of the volume.

Work on this book started in June 2015. It was more than a year later before the first chapter was posted online, mainly because of the several review rounds made on the original manuscripts (chapters). Once a chapter manuscript was approved by the editor of the book, it was sent to two reviewers, one of them having English as mother tongue. The author revised the manuscript based on the reviewers’ comments and the editor then read it again to check the overall quality of the manuscript. The chapter was then sent to Springer for production.

I would like to thank all the authors for their contributions. Without them there would be no book entitled “The Nile Delta.” Much appreciation and great thanks are also owed to the editors of the HEC book series at Springer. Special thanks to Prof. Andrey Kostianoy for his continuous support and advices. Words are not sufficient to thank the reviewers of this volume, Prof. Abdel-Razek Zidan, Emiratus Professor, Irrigation and Hydraulics Department, Faculty of Engineering, El-Mansoura University and Dr. Sommer Abdel-Fattah, Assistant Professor,

McMaster University, Hamilton, Ontario, Canada, for their great effort in reviewing, editing, and improving the quality of all the manuscripts to ensure the best possible quality.

Acknowledgements must be extended to include all members of the Springer team who have worked long and hard to produce this volume and make it a reality for the researchers, graduate students, and scientists around the world. Last, but not least, great thanks and a special appreciation to all the authors who have contributed to this volume. Without their patience and effort in writing and revising the different versions, it would not have been possible to produce this volume and make it a reality.

The volume editor would be happy to receive any comments to improve future editions. Comments, feedback, suggestions for improvement, or new chapters can be sent directly to the volume editor.

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