

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

The Nile River is the main source of water for Egypt, providing more than 97% of the country's water supply. Researchers from all over the world have recently become very interested in the challenges of and cooperation opportunities for the Nile River, particularly after the start of the construction of the Grand Renaissance Ethiopian Dam. This volume has been produced to answer many questions and to provide readers, researchers, and scientists with key facts about the Nile in its entirety, covering a variety of topics. This is not an easy task: 34 authors wrote 24 chapters in just over 6 months. Review and editing processes took another 6 months to ensure the highest quality of the technical contents of the book. The volume was sent to Springer, chapter by chapter, to be produced based on the online-first policy. The book is divided into seven parts, each of which comprises several chapters. In the introductory chapter "Nile River Biography and Its Journey from Origin to End," the author presents key facts about the Nile.

Part I of the book consists of four chapters. All of these are about the Aswan High Dam reservoir. In the chapter "Estimating the Life Time Span of Aswan High Dam Reservoir (AHDR) Using Numerical Simulation of Nubia Lake," the authors present the results of a hydrodynamic simulation using the CCHE2D model for Lake Nubia. Then the lifespan of the whole lake is estimated and compared with the cross sections method used by the concerned authority of the AHDR. In the chapter "A Satellite Remote Sensing Approach to Estimate the Life Time Span of Aswan High Dam Reservoir," the authors present a systematic approach to estimate the lifespan of AHDR using a satellite remote-sensing approach and compare the results obtained with those from numerical modeling and the traditional method adopted by the associated authorities of AHDR. The chapter "Estimating the Sediment and Water Capacity in the Aswan High Dam Lake Using Remote Sensing and GIS Techniques" explains the use of a satellite remote sensing approach and GIS technology to estimate the accumulated sediment in Lake Nubia. Then the total sediment in the AHDR is estimated. The results are comparable with estimations using the cross sections method that was adopted by the National Water Research Center, Ministry of Water Resources and Irrigation. The water quality of AHDR is

presented and discussed in the chapter “Water Quality Assessment of Aswan High Dam Reservoir.” Two water quality indices, the National Sanitation Foundation – Water Quality Index (NSF WQI) and the Canadian Council of Ministers of the Environment (CCME – WQI), and two trophic status indices (Carlson TSI and LAWA TI), are used to assess the southern part of AHDR.

Part II of the book presents results and a review of studies on Nile River morphology and sediment quality and movement from Aswan to the Nile Promontories. The chapter “Morphological Variation of the Nile River First and Second Reaches Using RS/GIS Techniques” presents the results of water surface change detection using satellite images from 1984 to 2010 for the river reaches from Aswan to Esna Barrages (1st reach) and from Esna Barrages to Naga Hammadi Barrages (2nd reach). The chapter “Bed Morphological Changes of the Nile River Downstream Major Barrages” presents the results of 2D numerical modeling to assess the bed morphological changes arising from controlling the release of the flow downstream of the Naga Hammadi Barrages. The author presents a stochastic procedure to deal with the uncertainty emerging from scarcity of available measured data for sediment in the River Nile. The results of analyzing different measurements of natural radioactivity found in the sediments of the Upper Egypt part of the Nile River are presented in the chapter “Distribution of Natural Radioactivity in the Egyptian Part of the Nile River from Aswan to El-Minia” and are compared with those of other authors. The chapter “Assessment of Water Quality and Bed Sediments of the Nile River from Aswan to Assiut, Egypt” presents the results of analyzing the measured physical and chemical parameters for water and sediment for two successive years from February 2011 to August 2012 at ten sites during low and high flow. The authors of the chapter “Morphology of the Nile River due to a Flow Rate over the Maximum Current: Case Study Damietta Branch” present the results of a numerical modeling to study the effect of increasing the flow rate to more than the current maximum on the morphology of the Nile River Damietta branch. An interesting study on bathymetry detection using satellite remote sensing for Rosetta branch (the second branch of the Nile) is presented in the chapter “Nile River Bathymetry by Satellite Remote Sensing Case Study: Rosetta Branch.” The authors provide detailed methodology and assess the performance of remote sensing in detecting the bathymetry in Rosetta branch where the water quality has deteriorated. This part of the volume ends with the chapter “Towards a Dynamic Stability of Coastal Zone at Rosetta Promontory, Egypt.” The authors of this chapter discuss the results of using calibrated/validated hydrodynamic and particle tracking models based on the 2D Coastal Modeling System software package (CMS) to test different scenarios to suggest the best scenario to maintain the dynamic stability of Rosetta promontory.

In Part III “Ecosystem, Fish and Fisheries” of the volume, three chapters are presented. The chapter “Ecosystem and Biodiversity in the Nile Basin: Case Study: Lake Nasser” describes aspects of environmental issues of ecosystem and biodiversity, endangered species, and threats to biodiversity in the Nile Basin countries with a focus on Lake Nasser as a case study. In the second chapter “Impact of Water Quality on Ecosystems of Nile River” the author discusses the different pollutants

of the River Nile in relation to the biotic and abiotic factors that affect water quality and the aquatic ecosystem as well as the interaction of the human activities on the Nile River water quality. The last chapter of this part is “Fish and Fisheries in the Nile Basin.” It describes the current status of the fish and fisheries of the Nile Basin and suggests several measures to improve the fish industry and to increase the productivity.

Part IV of this volume is “Upper Nile Challenges and Opportunities” and consists of four chapters. In “Trend Analysis of Precipitation Data: A Case Study of Blue Nile Basin, Africa” the author presents an assessment of the availability and quality of remotely sensed and global rainfall data as one of the important forcing collections of data which should be used to set up a hydrological model. The case study of the chapter is the Blue Nile Basin. The chapter “Recent Trends and Fluctuations of Rainfall in the Upper Blue Nile River Basin” presents a trend analysis of annual and seasonal rainfall data collected from 22 stations for 49 years over the upper Blue Nile Basin using non-parametric, Mann–Kendall tests and the Sen’s slope approach. In the chapter “Productivity of Rain-Fed Agriculture of Upper Nile River” the author discusses the rainfed agriculture activities and rainfed production systems in the Nile basin. The last chapter in Part IV is “Impacts of the Upper Nile Mega Projects on the Water Resources of Egypt.” The authors of this chapter explore the impacts of the mega projects (such as the Grand Renaissance Ethiopian Dam) – constructed on both White and Blue Niles – on other water resources of Egypt.

In Part V “Climate Change Variability, Vulnerability and Adaptation” two chapters are presented. The chapter “Nile Basin Climate Changes Impacts and Variability” discusses the climate changes and variability all over the basin and sub-basins. Its structure is around historical climatology and hydrology of Nile basin, variability of the Nile climate, in addition to the impacts of climate change on growth and development. In the chapter “Climate Changes Vulnerability and Adaptive Capacity” the authors discuss the different issues over the basin that are related to vulnerability and adaptive capacity over the Nile Basin. They show how scientific information can be used to prepare for climate changes and different climate model techniques in advance to provide economic opportunities and proactively manage the risks, and consequently how climate change impacts and their associated costs over time are reduced.

In Part VI “The Hydropolitics and Legal Aspects” two chapters are presented. The chapter “The Legal Aspects of the International Rivers: The Nile River as a Case Study” analyzes the legal dimensions of international rivers on the Nile River based on legal analytical methods. In doing so, the chapter covers the regulations of the uses of the international rivers, and consequently the rights of riparian states, the no-harm rule, the principle of equitable and reasonable utilization, and the legal status of the Nile River. The chapter “The Hydropolitics of the Nile River Basin” discusses and analyzes the hydropolitical interactions in the Nile Basin with a focus on conflictual interactions based on the hydropolitical framework. Several issues are analyzed including (1) the dimensions of the water conflict in the Nile Basin, with focus on the contradictory attitudes of the countries upstream and downstream

and on the Ethiopian hydropolitical behavior towards the Grand Renaissance Ethiopian Dam, (2) the role of the external factors in regional and international actions in the Nile Basin, and (3) the potential scenarios of the hydropolitics (conflict and cooperation) in the Nile Basin.”

Part VII, which contains the last chapter of the volume, presents an update of the recent publications on the topics presented in this volume and ends with the conclusions and recommendations highlighted by the authors.

The project for the production of this book was initiated on June 2015. It took more than 1 year before the first chapter was posted online 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 with English as native language. The author revised the manuscript based on the reviewers' comments and the editor then reread it to check the overall quality of the manuscript. Then the chapter was sent to Springer for production.

I would like to thank all the authors for their contributions – without their efforts there would be no “The Nile River” book. Great appreciation and thanks are due to the editors of the HEC book series at Springer, with special thanks to Prof. Andrey Kostianoy for his continuous support and advices. Words are not sufficient to thank Dr. Sommer Abdel-Fattah, Assistant Professor, McMaster University, Hamilton, Ontario, Canada for her great efforts in reviewing, editing, and improving the quality of all the manuscripts.

Acknowledgements are extended to all members of the Springer team who worked long and hard to produce this volume and make it a reality for graduate students, researchers, and scientists around the world. Last but not least, great thanks and special appreciation to all the authors who contributed to this volume. Without their patience and efforts 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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