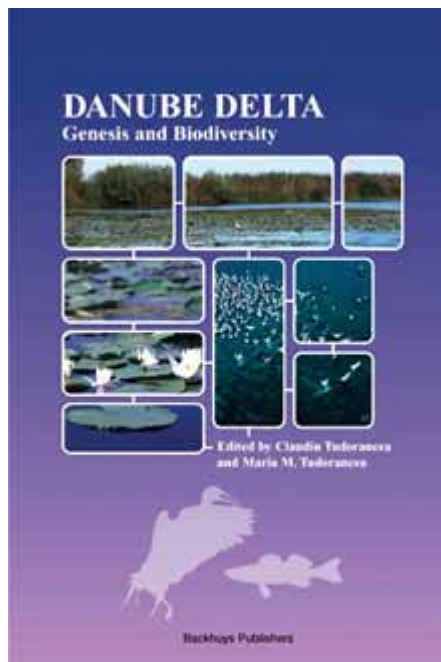


**THE FIRST BOOK IN ENGLISH ON A GREAT WORLD DELTA AND BIOSPHERE RESERVE: “DANUBE DELTA, GENESIS AND BIODIVERSITY”, C. TUDORANCEA & M. M. TUDORANCEA (EDS.), BACKHUYS PUBLISHERS, LEIDEN, THE NETHERLANDS.**

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Review

NEGREA Ștefan



The deltas of the large rivers are complexes of high diversity ecosystems whose functioning mechanisms are more complex and more subtle than those of the lakes and rivers, let alone great rivers flood plains. With few exceptions the scientific information on wetlands in general is poorer in comparison with that of other freshwater ecosystems. The Danube Delta is the second largest wetland zone in Europe, after the Volga Delta, and it has been declared a Biosphere Reserve, a Ramsar site and a World Natural Heritage. As the distinguished Emeritus Professor and great limnologist H.B.N. Hynes stated in his preface to this volume, this is the first book published in an international language about this large and important delta of the world. That is why the publication of this volume is more than welcome, even more for the specialists. In fact, the purpose of the present review is to signal to those who are not aware yet that this particular volume plainly deserves a place in every limnologist's personal library.

One of the great merits of the editors, the contributors and the publishers is that this book concentrates in one volume a large amount of scattered information from various journals, most of which are inaccessible to the international scientific community. The book is a result of the efforts of 20 reputed limnologists who are well respected in their area of research and who elaborated the 16 chapters. As for the editors, they have structured the information in such manner so that the reader can have a coherent understanding of each chapter. It has to be noted that despite the fact that

the Danube Delta is a complex of a high diversity of aquatic and terrestrial ecosystems, the book deals only with aquatic ecosystems which comprise about 80 % of the surface of the entire delta.

**Chapter 1 - The Introduction**, signed by C. Tudorancea, contains a general presentation of the Danube Delta, with its importance in terms of high biodiversity and as a “natural laboratory” for studies of various ecological processes.

**Chapter 2** (by N. Mihailescu) provides an excellent detailed presentation of the genesis and evolution of the Danube Delta based on geological, geomorphological and geochemical data. It is emphasised that both the shape and the dynamics of the Danube Delta are the result of the world wide climatic changes during Upper Pleistocene and Holocene. The formation and evolution of the two major lakes known as fluvio-marine and fluvio-lacustrine are documented in detail.

**Chapters 3, 4 and 5** (signed by V. Torica, A. Irimus and respectively C. Postolache) are devoted to the characterization of the deltaic environment from the climatic, hydrological and chemical point of view. It is documented the fact that the Danube Delta climate (Chapter 3) is a result of the interaction of the radiative (e.g. solar radiation), dynamic (e.g. general air circulation, air pressure, local air movements) and physico-geographical (e.g. thermal regime, wind regime, humidity regime, precipitations) factors. Several infrequent meteorological phenomena which may occur in the deltaic area are also mentioned. Chapter 4 provides data on the dependence of the water level of the deltaic lakes and ponds on the hydrological regime of the Danube River. The hydrological regime of the Danube Delta is a very complex one and all the biological processes including dynamics and production of the biological communities of the inner ecosystems are controlled by the hydrological regime of the river. Information on the influence of the Black Sea on the delta is unfortunately lacking. A remark is necessary. The great lake of Razim appears on all maps of the Danube Delta as L. Razelm – except the Fig. 4.1, of the Chapter 4. The geographer P. Gastescu demonstrated in his book, “*Lacurile Terrei*” (1079, p. 217, in Romanian) that the hydronym *Razelm* is due to a transcription error from the maps of the first half of the XX<sup>th</sup> century and that the locals are using only the hydronym of *Razim*. As a consequence, all atlases published after 1980 have used the latter name.

**Chapter 5** focuses on the impact of the hydrological regime of the river during the 195-1980's interval on the chemistry and eutrophication of different inner ecosystems of the delta. The amounts of sediments, nutrients and of

different pollutants including heavy metals, carried by the river in various periods have affected the quality of inner ecosystems of the delta with severe consequences on abundance and productivity of biological communities. Based on the dynamics of nutrients and on the changes in the DIN:TRP ratio the author considered the decade of the 1980s as a period of “ecological crisis” for the Danube Delta. The period of transition from mesotrophy to hypertrophy noted at the beginning of 1980s was characterized by increase in the content of dissolved organic matter, oxygen depletion, algal blooms, and low water transparency. The deterioration of water quality led to severe changes in biodiversity such as a loss of some submerged macrophytes, weed-bed fauna, microphytobenthos and some filter feeders.

**Chapter 6** makes a general presentation of the habitat and ecosystem categories of the Danube Delta. The authors (N. Galdean and D.M. Ruști) present 10 types of ecosystems, including the terrestrial and calcareous islands. Emphasis is given to the macrophytic cover including the very characteristic formation of the delta, namely “reed islet community” (“plaur”). A more detailed analysis of the deltaic ecosystems and of the relations between them would have been more informative and useful.

The **chapters 7 to 15** provide comprehensive information on the major biological components of aquatic ecosystems studied, beginning with the primary producers (Chapters 7 and 8) and ending with the top consumers, fish and birds (Chapters 14 and 15).

Based on data collected during the last seven decades, the deltaic phytoplankton (Chapter 7, by I. Caraus and N. Nicolescu) is characterized by the dominance of Chlorophyceae followed in decreasing order by Diatomaceae and Cyanobacteria. Increase in algal density and biomass as well as the occurrence of algal blooms were associated with increase in nutrients content discharged by the Danube. Particularly useful for the algae taxonomists, the chapter comes with an addendum containing a list of 1098 algal species identified to day in the Danube Delta.

**Chapter 8** (signed by A. Sârbu) provides detailed information on the composition, dynamics, and the role in the nutrient cycling and as a feed-back mechanism in the ecosystem of the macrophytes. Changes in macrophytic composition, density, biomass and production, are discussed in relation with the river discharge, nutrient input and level of eutrophication.

The composition, the multiannual and seasonal changes in density, biomass and productivity of zooplankton are documented in **chapter 9**, under the signature of V. Zinevici and L. Parpală. The authors of the chapter present the zooplankton community structure in terms of primary and secondary consumers. Primary consumers were represented mainly by rotifers, ciliates and cladocerans while the secondary consumers were represented mainly by copepods and rotifers. Multiannual changes in zooplankton community structure and production were associated with levels of eutrophication and the dominance of either macrophytes or phytoplankton in different years and seasons.

**Chapter 10** (by C. Tudorancea) summarizes the information on benthic fauna, excluding meio- and micro-benthos. The major benthic groups of macroinvertebrates which dominated benthic fauna in terms of number of species were Chironomidae, Gastropoda, Oligochaeta, Trichoptera and Bivalvia, in their decreasing order. Of particular scientific interest is the origin of the benthic fauna of the Danube Delta. Some species are of Palaearctic and Holarctic origin, others are Pontoazov-Caspian relicts, and some are of Mediterranean origin. One exotic gastropod species, characteristic for southern hemisphere, was identified in delta, as well. Composition and distribution of the benthic fauna is discussed related to different habitats such as mainstreams, lakes and ponds and channels. A special attention is given to benthic invertebrates inhabiting the new marine lagoons which are in the process of becoming freshwater ecosystems.

**Chapter 11** (written by G. Rasnoveanu) refers to Oligochaeta, as a main component of the benthic fauna, and to their importance for characterization of the trophic state of various aquatic ecosystems of the delta.

**Chapter 12** (signed by C. Ciubuc and O. Ciolpan) is devoted to one of the most important and often the least approached component namely the weed-bed fauna. This is perhaps the habitat with the highest biodiversity in the delta. The weed-bed assemblage is numerically dominated by phytophile Chironomidae followed in decreasing order by Gastropoda, Coleoptera, Odonata, Oligochaeta, Trichoptera and Hydrachnidia. The authors illustrated in a very suggestive figure the continuous and the seasonal movements of the weed-fauna between bottom and macrophytic substratum due to the disappearance of vegetation during cold season.

Of particular scientific interest is **Chapter 13** in which D. Ionica focuses on the benthic microbial communities. The author documented the role of benthic microorganisms taking part in nitrogen, carbon and sulphur cycles. Of very practical importance in the assessment of the trophic level of a particular aquatic ecosystem, several indices based on bacterial benthic community are recommended. It is unanimously accepted that the fish and the waterfowl represent the wealth of the Danube Delta.

**The chapter 14**, “Ichthyofauna of the Danube Delta”, under the signature of K.W. Battes and F. Pricope, summarises information on the fish fauna which comprises species with dispersal centre in the Danube and the Danube Delta, Ponto-Caspian-Aral, Euro-Mediterranean, Caspian-Aral, Euro-Siberian and Holarctic origin. Nine exotic species have been acclimatized and several natural hybrids have been recorded, as well. A wide range of topics are discussed involving fish migration, individual growth, reproductive biology, feeding, and fish yield. The authors emphasize several factors, which led to a decrease in number of species from 64 in the 1960’s to 47 in 1992, and to a drastic reduction in fish yield within the last three decades.

**Chapter 15** is signed by Dan Munteanu who provides information on the bird fauna, one of the main attractions, not only for the ornithologists but for any tourist visiting Danube Delta. More than 300 species of birds have

been recorded in the Danube Delta, of which more than half breed in this area. The author presents numerous and various aspects such as breeding and non-breeding fauna, occasional species and factors determining avifauna composition of the delta.

The last chapter of the book, named "Human presence in the Danube Delta" (by M. M. Tudorancea), is devoted to the human activities in the area, the threats and the conservation strategies. Although this chapter is not a very extensive one, it is a welcome summary of the historical human presence in the Danube Delta, from more than 2500 years ago, and to the main activities practised in this area with consequences for the future of the delta. The main activities such as fishing, agriculture and reed harvesting have been traditionally practiced in the Danube Delta. However, activities such as damming of the floodplain along the Danube River and within the delta in order to increase the agricultural production, the development of mechanization in reed grass harvesting as well as various hydrotechnical works (channels, dams, platforms etc.), led to severe deterioration of deltaic ecosystems with consequences on the biodiversity and the quality of ecosystems, which in turn affect the human economy and the life trend of the local populations. The conservation strategies should include joint international and national efforts for protection of the Danube River and its catchment basin as well as for rehabilitation of the Danube Delta ecosystems. With this noble purpose, this chapter could have closed with a call to the protection of the Delta, before the Danube turns definitively in the sewerage system of Europe's polluted waters in their way to the Black Sea.

Although there is some overlap of content among various chapters, which is inherent in multiauthored books, the authors and editors managed to follow a logical thread underlining the role and the importance of the Danube River hydrological regime in controlling the biological processes of the deltaic ecosystems.

The book is a true monographic work, an outstanding contribution to the knowledge of one of the largest wetland zone of Europe, and it may serve as a reference volume not only in terms of scientific information but also as a holistic way of understanding and approaching limnological studies. The book is well illustrated with high quality tables and figures, and it has a subject and a taxa index which facilitate the reader. We would have loved a name index as well. Despite of few typographical errors and of the fact that the English is not the native language of the contributors, the book is easy to read and understand.

I think that the editors, the contributors and the prestigious Backhuys Publishing House deserve the appreciation of their pairs, limnologists and all who are studying the Earth's continental waters for this first stimulating synthesis of knowledge of a large river delta - a place still rich in virgin territories. The book deserves a high recommendation and would be a most useful addition to the basic libraries of limnologists, freshwater ecologists, and environmental managers.

**Negrea Ștefan**

The "Emile Racovitza" Speleological Institute,  
13 Septembrie street, M239, Bucharest, 050711, Romania  
E-mail: stnegrea@yahoo.com

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