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The 40th Anniversary Conference of the International Association for Danube Research (IAD) *The Danube and Black Sea Region – Unique Environment and Human Well-Being Under Conditions of Global Changes*: Scientific Topics, Contributions and Results

Roumen Kalchev, Teodora Trichkova

Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 2 Gagarin Str., 1113 Sofia, Bulgaria;
E-mails: rkalchev@zoology.bas.bg; trichkova@zoology.bas.bg

Abstract: This review article summarises some of the contributions presented at the 40th Anniversary Conference of the International Association for Danube Research (IAD) held in Sofia, 17-20 June 2014. The current volume of *Acta zoologica bulgarica, Supplement 7,* comprises 31 contributions covering seven of the nine conference topics, one project review and three papers devoted to the memory of the respected Bulgarian hydrobiologists, including their bibliography related to the Danube River. The contributions focus on a wide range of current issues, such as bacterial, plant and animal diversity, ecosystem services, climate change and invasive alien species, the implementation of the Water Framework Directive, and sustainable development in the Danube River Basin. The results demonstrate the achievements of the scientific community and the potential for scientific cooperation within the frame of IAD.

Key words: Danube River, 40th IAD conference, contributions

Bulgaria had the honour to host the 40th Anniversary Conference of the International Association for Danube Research (IAD), entitled: ***The Danube and Black Sea Region – Unique Environment and Human Well-Being Under Conditions of Global Changes.*** The conference was held on 17-20 June, 2014, in Sofia, and it was the fourth conference organised in Bulgaria, after those held in Varna in 1966, in Sofia in 1976 and again in Varna in 1990. Following the good traditions of the Bulgarian Danube River limnology from the past, this scientific event was dedicated to the memory of the eminent and highly respected Bulgarian hydrobiologists Prof. Dr. Wesselin Naidenow (Botev, Trichkova 2014), Prof. Dr. Boris Russev (Vidinova, Tyufekchieva 2014) and Assoc. Prof. Dr. Milen Vassilev (Apostolou, Pehlivanov 2104), who as longtime IAD leading scientists, devoted much of their efforts and time to the study of the Danube River, and who have made valuable contributions in the areas of the Danube zooplankton, macrozoobenthos and fish community composition and dynamics.

The Conference was co-organised by the Bulgarian Academy of Sciences, the Institute of Biodiversity and Ecosystem Research, the Ministry of Environment and Water of Bulgaria, and the IAD General Secretariat. It was held within the framework of the Bulgarian Presidency of the International Commission for the Protection of the Danube River (ICPDR) in 2014 which also coincided with the 20th anniversary of the Danube River Protection Convention.

The 40th IAD Conference provided a forum for the presentation of long-term multidisciplinary research activities and discussions on various topics highlighting the application of ecosystem and sustainable development approaches, which are essential in order to strike a balance between the economic development and protection of the unique environment in the Danube River Basin. The contributions and discussions during the conference covered the following scientific topics:

1. Biodiversity – freshwater, riparian and floodplain flora and fauna, conservation, soil diversity and protection.
2. Protection and rehabilitation of Danube sturgeons.
3. Ecosystem services, wetlands, sustainable use of biological resources.
4. Climate change, habitat change, hydromorphology.
5. Invasive alien species – early warning, priority species and pathways, risk assessment and management.
6. Water quality elements, ecological status, emerging pollutants, microbiology, ecotoxicology, biomonitoring and saprobic systems.
7. Ecological functions and integrated basin management of lotic and lentic ecosystems.
8. Riparian landscapes, landuse, flood risk assessment, hydrological modelling and restoration.
9. Sustainable development and public participation in the Danube and Black Sea region.

The current volume of *Acta zoologica bulgariaca* comprises 31 contributions within 7 of the initially announced scientific topics, one project review and three papers devoted to the memory of the respected Bulgarian hydrobiologists, including their bibliography related to the Danube River.

Topic 1: Biodiversity – freshwater, riparian and floodplain flora and fauna, conservation, soil diversity and protection

There are eight contributions on the first topic, which focus on biodiversity of species and habitats belonging to the river and its catchment.

Tarjányi, Berczik (2014) investigated the spatial distribution of phytophilous macroinvertebrates in a side arm of the Middle Danube River (Hungarian part) - the Mocskos-Danube side arm and Riha Oxbow in submerged (*Ceratophyllum demersum*) and in emerged (*Trapa natans)* stands. The average abundance of macroinvertebrates in the marginal band of *C. demersum* patches relates to the central parts as 3:1. The habitat diversity in *C. demersum* stands was greater than in *T. natans* patches and as a consequence the latter has a lower number of species.

Popović *et al.* (2014) studied three populations of *Merodon avidus* species (Diptera: Syrphidae) in the region of Djerdap and Fruska Gora, Serbian Danube River sector, in order to delimitate cryptic taxa within the species complex by means of molecular markers. The morphological characters and the molecular markers of allozymes confirm the occurrence of *M. avidus* Rossi and *M. moenium* Wiedemann, while the mtDNA sequences fail to discriminate these two taxa. Therefore, the authors recommend the integrative usage of allozyme and morphological markers for species identification.

Two papers of Liashenko, Zorina-Sakharova (2014a, b) are devoted to the study of macroinvertebrates in the Ukrainian part of the Danube Delta. The first one focuses on the variation of species richness in the wide ecotone zone between the riverine freshwater and marine environment in Kyliya branch. The authors report that the mixing zone between fresh and marine water is distinguished by low diversity and abundance, which seems to deviate from the ecotone concept, according to which the abundance and diversity should increase (Odum 1986). However, Liashenko, Zorina-Sakharova (2014a) demonstrate that the transition zone is heterogeneous and the extension of the delta into the sea leads to the formation of bays along the coastline, where the stabilisation of abiotic indices increases, which causes also an increase in species richness. The marine environment is distinguished by higher abundances of Polychaeta, Amphipoda and other Crustacea species, while the freshwater habitats support more abundant Gastropoda, Oligochaeta and Insecta populations. Liashenko, Zorina-Sakharova (2014b) continue their study on macroinvertebrates in the transition zone between the fresh and saline waters in two other

branches of the Danube Delta - Bystryi and Vostochnyi. Only 10% of the benthic macroinvertebrates of the drift, mainly euryhaline and eurytopic species, mostly from Crustacea, transported by the river, manage to survive in the open waters of the marine zone.

The following two papers are related to fish species diversity in the Middle Danube River, Hungarian sector (Potyó, Guti 2014, Weiperth 2014). Potyó, Guti (2014) show that standard monitoring of fish abundance and species composition in rivers by electrofishing undergoes considerable fluctuations depending on the day-night cycle, the river size and water regime (low or high water levels). In the Danube River at Szob (rkm 1709-1707), the authors recorded the highest species richness at night and during low water levels. However, the day and night difference in species richness and abundance is not significant in a small stream and is increasing with the size of the watercourses.

Weiperth (2014**)** in his study on the juvenile fish community in the lower section of the Ipoly River from Ipolytölgyes to the mouth, and five sections along both banks of the Danube River downstream the Ipoly mouth reports a high species richness, with cyprinids preferring large woody debris and flooded terrestrial vegetation, while gobies occurring in ripraps. The author concludes that not only the different habitats but also distant spawning and nursing zones of a tributary are of importance for the fish community in the Danube River.

In their paper Weiperth *et al*. (2014) present a comprehensive survey of dice snake *Natrix tessellata* (Laurenti, 1768) diet in 10 countries from the Danube River Basin. The feeding spectrum includes 38 fish and 6 amphibian taxa with differences among Lower Danube (Bulgaria, Romania), Middle Danube (Hungary) and Upper Danube River (Austria) countries.

The paper of Afanasyev *et al.* (2014) presents results of river re-naturalisation in the Tisza River Basin, after forest cutting activities. River re-naturalisation actions, taken by the authors included clearing of timber remains, restoration of natural conditions by means of building rapids, spits and capes from local stones, and creation of depth drops and areas with different flow velocity. These works were followed by stocking the stream with invertebrates and fish. The observed recovery of benthic and fish communities leads the authors to conclude that even little efforts for re-naturalisation may result in fast and considerable improvement and restoration of the river biota and ecological status.

Topic 2: Protection and rehabilitation of Danube sturgeons

The restoration of the Danube sturgeons in the Danube River has focused the attention of scientists, because of their current high conservation status. Gutti (2014) makes a review of the major threats to sturgeons: historical over-exploitation, loss of spawning habitats, interruption of migratory routes between the key habitats and pollution. According to our present knowledge both, Iron Gates up- and downstream migrations of sturgeons seems to be questionable and of very limited efficiency. The author makes a conclusion that the conservation measures should be focused downstream of the Iron Gate dams, where the populations should be restored in order to have individuals able to migrate upstream.

Lenhardt *et al*. (2014) strongly support the general considerations of Gutti (2014) by underlining that there is still lack of data on sturgeon spawning, nursing and overwintering habitats in the Serbian Danube River sector. The absence of reliable estimates of number of sturgeons migrating upstream the Iron Gate II dam and their spawning success also hinders the protection measures, whose efficiency additionally requires an international cooperation against illegal sturgeon fishery.

Topic 3: Ecosystem services, wetlands, sustainable use of biological resources

The world wide recognised importance of wetlands is reflected in a significant number of conference contributions. Kalchev *et al.* (2014) compared and analysed differences and factors influencing the nutrient and other chemical variables in the Middle Danube (Hungarian) and Lower Danube (Bulgarian) wetlands. The results indicate that the Bulgarian wetlands have higher TP concentrations than the Hungarian wetlands, which in turn show higher TN concentrations. The wetland morphological connectivity with the river seems to influence stronger the nutrient dynamics in the Lower Danube, while the flow availability and direction are of significant importance in the Middle Danube wetlands.

The hydrological regime influences strongly also the bacterial abundance in the pelagial of the Bulgarian wetlands. Their number increased in 2011 when the water level was low and decreased in 2012 after the renewed flooding followed the total dry up of some wetlands (Kalcheva *et al.* 2014). Turbidity, chemical oxygen demand, total nitrogen and wetland depth were positively related, while ammonium and the distance from the Danube River were negatively related to the morphology type and size dynamics of bacterioplankton.

Kazakov *et al.* (2014) extended the comparison between the Middle Danube (Hungarian) and Lower Danube (Bulgarian) wetlands in respect to zooplankton species diversity. Fifty and fifty-five rare species were recorded in the Hungarian and Bulgarian wetlands, respectively. The Detrended Correspondence Analysis shows a separation both between Middle and Lower Danube wetlands, as well as within the two sectors according to the wetland connectivity to the river.

The restored hydrological regime was also crucial for the restoration progress of four wetland areas (Babina, Cernovca, Popina and Fortuna) of the Danube Delta Biosphere Reserve in Romania monitored by macrophyte species composition (Schneider 2014).

The restoration of large wetland areas in the Lower Danube River aims at preserving the biodiversity and extending the range and efficiency of ecosystem services. However, the results show that not all known from the past services of the wetlands in Bulgaria can be restored even after implementing rehabilitation/ conservation and appropriate management (Pehlivanov *et al.* 2014). This mostly concerns the exploitation potential of wetland natural resources (*e.g.* fishery, reed bed materials, flooded meadows and related cattle breeding, and floodplain forestry).

Topic 4: Climate change, habitat change, hydromorphology

The hydrological regime of the Danube River and its catchment being in most cases of primary importance for events and development of biodiversity and ecological status is increasingly dependent on global climate changes. For this reason the Danube water's isotope time series as a basic data set are a powerful tool for hydrological investigations, as well as for assessing future impacts within the Danube River Basin including climatic/ hydrological changes (temperature changes, change of precipitation distribution), as well as anthropogenic impacts on the hydrological regime caused by reservoirs, changes in land use, etc. (Rank *et al.* 2014).

Another useful tool for determination of the pristine hydrogeomorphological conditions in the river-floodplain ecosystem is the historical habitat analysis (Hohensinner *et al.* 2005) successfully applied by Farkas-Iványi, Guti (2014). By means of historical maps from the early 19th century in the Szigetköz floodplain of the Danube River the authors show how the effects of channelisation has led to an areal decline in aquatic habitats, change in river bed load transport, and a decrease in the lateral river-floodplain connectivity.

Schwarz (2014) presents the development of a new method for continuous hydromorphological assessment of the Danube River by subdividing it in 10 km segments. Besides a concise hydromorphological assessment of the navigable Danube River the 10 km long assessment stretches can be applied for any further interdisciplinary purposes, *e.g.* sediment and nutrient fluxes, monitoring of habitats and species, floodplain assessments and also such demanding task as preparation of hydromorphological reference conditions in large rivers. The latter should present the necessary firm fundament for a successful implementation of the Water Framework Directive of the European Union (EU WFD) in the Danube River.

Zorina-Sakharova *et al.* (2014) present the results about zooplankton species composition in the Danube Delta in relation to the salinity. The authors report a decrease of species richness with the increase in salinity. A more pronounced sharp decline in zooplankton is observed at about 2‰. The calculated linear regression equations between salinity and number of zooplankton species indicate that the group of freshwater mesohaline species is the most abundant (≈17 species), followed by freshwater oligohaline species (≈11), and only about 6 freshwater species at zero salinity. The sharpest decline with salinity increase is observed in the number of freshwater mesohaline, and the lowest in freshwater species.

The resulted modified recent morphology of the Hungarian Danube River sector and hydrological re-

gime related to it are among the main environmental factors, which determine the species diversity in the wetlands, including that of zooplankton species studied by Kiss *et al.* (2014) in the period 2002-2009. The results are similar to those about water chemistry in the Hungarian Danube in Kalchev *et al.* (2014), and show that the occurrence of flow, as well as the connectivity and hydrological distance to the main arm are the main factors that influence the density and diversity patterns of zooplankton assemblages (Kiss *et al.* 2014).

Topic 5: Invasive alien species – early warning, priority species and pathways, risk assessment and management

Although invasive alien species pose a growing threat to the Danube River Basin recently, only one paper focus on this topic. Puky (2014) reports on an adult form of the spiny-cheek crayfish *Orconectes limosus* (Rafinesque, 1817), which was observed walking from the Szeremle dead arm towards the Danube River in Hungary. It is the first record of *O. limosus* in the Danube River catchment crossing on land from one water body into another. This behaviour definitely helps the colonisation of new water bodies when only small stretches of land separate inhabited and non-inhabited water bodies, or allow the use of terrestrial escape routes in case of desiccation or pollution of the water body.

Topic 6: Water quality elements, ecological status, emerging pollutants, microbiology, ecotoxicology, biomonitoring and saprobic systems

The ecological status of aquatic ecosystems and the water quality elements applied for its evaluation are one of the central issues of the recent ecological research. The high human impact on the Danube River, such as the considerable hydromorphological changes and diverse long-lasting pollution, represents a special challenge for implementation of the requirements of EU WFD in the Danube River Basin.

One of the biological quality elements used in the ecological assessment is the phytoplankton. The paper of Dokulil (2014) aims at the study of the phytoplankton longitudinal long-term variations. The author notes that despite the observed decline in pollution and turbidity and increasing significance of nutrients for algal growth, the dominance of diatoms, particularly centric taxa, is still persisting. Furthermore, the complex character of hydrology of the Danube River and the variability of timing of phytoplankton seasonal maxima complicate the water quality evaluation according to the EU WFD.

The paper of Mihaljević *et al.* (2014) also focuses on the assessment of ecological status of the Danube River by means of phytoplankton, but by application of algal species functional groups. By means of redundancy analysis the authors reveal that the higher percentage of variance is explained when the environmental factors are related to algal composition presented by morphology-based functional groups than by classical taxonomic classification. This study is a valuable confirmation of several previous investigations reporting similar results for the functional group classification of phytoplankton algae (Kruk *et al.* 2002, Beshkova *et al*. 2010, Salmaso *et al.* 2012).

Liashenko (2014) presents results on water quality assessment in the Ukrainian part of the Danube Delta by means of biotesting (using Daphnia magna, Allium cepa and Lactuca sativa as toxicity test organism) and bioindication (using Trent Biotic Index, Belgian Biotic Index, Biological Monitoring Working Party Index, and Goodnight-Whitley Index based on macrozoobenthos). The biotesting shows a slow decrease in the toxic impact level from 2007 to 2012, while the biotic indices mostly reveal a *Poor* ecological status for all sampling stations through all years of monitoring. This allowed the author to exclude the toxic pollution from the main causes of low water quality in the Ukrainian part of the Danube Delta.

The macrozoobenthos, being the most frequently applied biological quality element for the assessment of ecological status of river ecosystems, was also used in the study of Ihtimanska *et al*. (2014) in the Bulgarian sector of the Danube River. The authors compare the macrozoobenthos taxonomic groups with environmental variables and find out that most of the macrozoobenthic groups have positive correlations with the concentration of nutrients and negative with the concentration of heavy metals. The macrozoobenthos together with water physical and chemical parameters was also applied for ecological status assessment of Ogosta River, a Bulgarian tributary of the Danube River, by Stoyanova, Traykov (2014). The au-

thors reported a *Bad* ecological status downstream of Montana town and a *Moderate* status in the remaining stretch further downstream until the inflow into the Danube River.

Jovičić *et al.* (2014) made an assessment of the current state of fish resources and elemental pollution in Belgrade fishery waters, in order to establish a good basis for the development of a monitoring system on the state of fish stocks and their exploitation. The content of variety of heavy metals in tissue of many fish species was below the maximum allowable concentrations; nevertheless the authors recommend including fish only in limited quantities in human diet and selected pikeperch and freshwater bream for monitoring of fish meat quality. It is recommended that the implementation of fishery monitoring program should comprise both economically important fish species and certain nonindigenous species.

Pavlova, Rabadjiev (2014) studied the relation of fish species composition to some environmental variables including nutrients and heavy metals in both water column and sediments, as well as sediment size structure in the Bulgarian Danube River sector. They reveal the bottom substrate as a leading natural environmental factor for the distribution of fish community along the riparian zone (similar results as in Weiperth 2014**),** as far as there are no significant hydromorphological changes along the Bulgarian Danube River sector.

Kazakov *et al.* (2014) assessed the ecological status of stagnant water bodies of four Danube wetlands in Bulgaria using the ECOFRAME approach, which was developed for shallow lakes within the implementation of the EU WFD (after MOSS *et al*. 2003). The results suggest that the ECOFRAME method needs further verification for the specific conditions of shallow oxbow lakes in the Lower Danube River floodplain. It should be noted, that according to EU WFD, the wetlands have to be considered as part of the surface water body they belong to, when evaluating their ecological status (Common Implementation Strategy for the Water Framework Directive (2000/60/EC), Guidance Documents No 12, 2003).

Ágoston- Szabó *et al.* (2014) studied the decomposition dynamics of willow (*Salix alba*) leaf litter in Nyéki Danube Oxbow Lake, Hungarian Danube River sector. The authors report that fungi significantly contribute to the breakdown of willow leaf litter and the main factors that influence the decomposition are the litter quality, pH and the temperature of surrounding water.

Topic 7: Ecological functions and integrated basin management of lotic and lentic ecosystems

There is one contribution on this topic by Mierlă *et al.* (2014), which focus on flood risk and its effect on environmental parameters, such as soil and land (vegetation) cover types in the area of the Romanian part of the Danube Delta. Different soil and land cover types were affected in different way by floods, which happened within 30, 100 and 1000 years. The results can be applied in composing flood risk management plans, particularly in areas located close to water bodies (stagnant or running waters).

Project Review

Winiwarter, Haidvogl (2014) make a review of the project *Danube: Future*, whose aim is to contribute to the sustainable development in the Danube River Basin with particular focus on humanities. The project is a multi-year program (2013-2020). It consists of two modules: (a) capacity building and (b) sustainability related research with a long-term socio-ecological component. The capacity building module started in 2013 with a first series of International Schools to be held yearly at least until 2015. However, it is envisaged to establish the International Schools as permanent activity beyond 2015 and 2020, respectively. Further information about the project, its structure, aims and work can be found on www.danubefuture.eu.

Conclusions

The published contributions in this volume show the active participation of scientists from most of the Danube countries. There are 11 scientific papers from Hungary, followed by Bulgaria (8), Ukraine (5), Austria (4) and Serbia (3). Scientists from Germany, Croatia, and Romania published one paper per each country. Unfortunately, only two papers are a result of co-authorship between scientists from more than one country, namely between Hungary and Bulgaria. However, a great potential of international scientific cooperation within the Danube River Basin exist and it should be further developed following the good example of IAD.

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