INTERNATIONAL ASSOCIATION FOR DANUBE RESEARCH (IAD)

IAD 40th Anniversary Conference

The Danube and Black Sea Region: Unique Environment and Human Well-Being Under Conditions of Global Changes

Book of Abstracts

Sofia, Bulgaria
2014

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17-20 June 2014
SOFIA, BULGARIA

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The Conference was organised and supported by:

Bulgarian Academy of Sciences (BAS)
Institute of Biodiversity and Ecosystem Research (IBER)
Ministry of Environment and Water of Bulgaria (MOEW)
General Secretariat IAD

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CONFERENCE PROGRAM

Monday, 16 June 2014

10:00 – 17:00 **Payment of conference fee** at the Accounting office of the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences (IBER-BAS), 1 Tsar Osvoboditel Blvd., Sofia

13:00 – 17:00 **Registration** at the lobby of the Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences (IBER-BAS), 1 Tsar Osvoboditel Blvd., Sofia

14:00 **Meeting of IAD National representatives and Expert group leaders** at the Meeting room of the National Museum of Natural History, 1 Tsar Osvoboditel Blvd., Sofia

Tuesday, 17 June 2014

Conference venue: Conference Hall of the Bulgarian Academy of Sciences, 1, 15th November Str., Sofia

*The time of **keynote lectures** includes 30 min presentation and 10 min discussion.*
*The time of **oral presentations** includes 15 min presentation and 5 min discussion.*

08:00 – 09:00 **Registration and payment of conference fee**

09:00 – 09:30 **Opening**
THOMAS HEIN, IAD President
DIMITAR IVANOV, Scientific Secretary, BAS
SNEJANA GROZEVA, Scientific Secretary, IBER-BAS
ROUMEN KALCHEV, IAD Country Representative of Bulgaria

Topic 6: Water quality elements, ecological status, emerging pollutants, microbiology, ecotoxicology, biomonitoring and saprobic systems
Chairpersons: GEORG JANAUER, YORDAN UZUNOV

09:30 – 10:10 **Keynote lecture**: MARTIN DOKULIL – The ecological importance of river phytoplankton: Potamoplankton regained

10:10 – 10:30 MELITA MIHALJEVIĆ, FILIP STEVIĆ, DUBRAVKA ŠPOLJARIĆ, TANJA ŽUNA PFEIFFER – Application of morpho-functional classifications in the evaluation of phytoplankton changes in the Danube River

10:30 – 10:50 STEFAN PREINER, THOMAS HEIN – Modeling of aquatic primary production patterns in the Danube River floodplain Lobau

10:50 – 11:10 MARTIN DOKULIL – Phytoplankton of the Danube River: Composition and long-term dynamics

11:10 – 11:30 **Coffee break**

11:30 – 11:50 VESELA EVTIMOVA, LYUBOMIR KENDEROV, NADJA OGNJANOVA-RUMENOVA, ZDRAVKO HUBENOV, IVAN BOTEV, TEODORA TRICHKOVA – Ecological assessment based on benthic diatom and macroinvertebrate communities in the Bulgarian section of the Danube River

11:50 – 12:10 MILA IHTIMANSKA, EMILIA VARADINOVA, STEFAN KAZAKOV, RADOSTINA HRISTOVA, SVETLANA NAUMOVA, LUCHEZAR PEHLIVANOV – Preliminary results on the distribution of macrozoobenthos along the Bulgarian stretch of the Danube River with respect to loading of nutrients, heavy metals and arsenic

Topic 1: Biodiversity – freshwater, riparian and floodplain flora and fauna, conservation, soil diversity and protection
Chairpersons: GEORG JANAUER, YORDAN UZUNOV

12:10 – 12:30 BELA CSÁNYI, MILA IHTIMANSKA, MOMIR PAUNOVIĆ, JÁNOS PODANI, JÓZSEF SZEKERES – Proposed section typology of the Danube River based on macroinvertebrates collected by different sampling methods

12:30 – 14:00 **Lunch break**

Topic 2: Protection and rehabilitation of Danube sturgeons
Chairpersons: GUNTHER SEITZ, LUCHEZAR PEHLIVANOV

14:00 – 14:40 **Keynote lecture:** CRISTINA SANDU – Sturgeon conservation in the Danube River Basin: the way forward

14:40 – 15:00 GÁBOR GUTI – Can anadromous sturgeon populations be restored in the Middle Danube River?

15:00 – 15:20 MIRJANA LENHARDT, MARIJA SMEDEREVAC-LALIĆ, VESNA ĐIKANOVIĆ, GORČIN CVIJANOVIĆ, ZORAN GAČIĆ, IVAN JARIĆ – Past and current investigations of sturgeons in Serbia – analysis of critical gaps that should be resolved to achieve their successful conservation

15:20 – 15:40 **Coffee break**

Topic 1: Biodiversity – freshwater, riparian and floodplain flora and fauna, conservation, soil diversity and protection
Chairpersons: GUNTHER SEITZ, LUCHEZAR PEHLIVANOV

15:40 – 16:00 DORU BĂNĂDUC, ANGELA CURTEAN-BĂNĂDUC – The influence of environmental variables on the structure and diversity of fish communities – A Carpathian river case study

Topic 6: Water quality elements, ecological status, emerging pollutants, microbiology
Chairpersons: GUNTHER SEITZ, LUCHEZAR PEHLIVANOV

16:00 – 16:20 MILENA PAVLOVA, YAVOR RABADZHIEV – Effect of some environmental parameters on the composition of fish communities in the riparian zone of the Bulgarian Danube River section

16:20 – 16:40 KATARINA JOVIČIĆ, MIRJANA LENHARDT, ŽELJKA VIŠNJIĆ-JEFTIĆ, VESNA ĐIKANOVIĆ, STEFAN SKORIĆ, MARIJA SMEDEREVAC-LALIĆ, GORČIN CVIJANOVIĆ, MILICA JAĆIMOVIĆ, ZORAN GAČIĆ, IVAN JARIĆ, ALEKSANDAR

HEGEDIŠ – Assessment of fish stocks and elemental pollution in the Danube, Sava and Kolubara Rivers on the territory of the city of Belgrade, Serbia

19:00 **Welcome dinner** (Dondukov Beer House, 14 Dondukov Blvd., Sofia)

Wednesday, 18 June 2014

Topic 8: Riparian landscapes, landuse, flood risk assessment, hydrological modelling and restoration
Chairpersons: ULRICH SCHWARZ, ROUMEN KALCHEV

09:00 – 09:20 MILAN LEHOTSKÝ, ANNA KIDOVÁ, JÁN NOVOTNÝ, PETER SKUBINČAN – Riparian zone land cover: Classification, changes and trends of development
09:20 – 09:40 MARIAN MIERLĂ, IULIAN NICHERSU, CRISTIAN TRIFANOV, IULIANA NICHERSU, EUGENIA MARIN, FLORENTINA SELA – Links between Selected Environmental Components and Flood Risk in the Danube Delta
09:40 – 10:00 THOMAS HEIN, ELISABETH BONDAR-KUNZE, ANDREA FUNK, GWENDAL PAGET, STEFAN PREINER, GABRIELE WEIGELHOFER, NINA WELTI – Carbon and nutrient dynamics in highly altered riverine landscapes of the Danube River: Importance of scaling
10:00 – 10:20 ANTONETA SEGHEDI, MARIAN TRAIAN GOMOIU, GHEORGHE OAIE – The Danube River in 1837 – the Demidoff expedition

10:20 – 11:00 Coffee break

Topic 4: Climate change, habitat change, hydromorphology
Chairpersons: ULRICH SCHWARZ, ROUMEN KALCHEV

11:00 – 11:40 **Keynote lecture:** IVAN ZAVADSKY (Executive Secretary of ICPDR) – 20 Years of international water management: Transboundary cooperation in the Danube River Basin
11:40 – 12:00 DIETER RANK, STEFAN WYHLIDAL, KATHARINA SCHOTT, MARTIN JUNG, GERHARD HEISS, MARIAN TUDOR – A 50 years' isotope record of the Danube River water and its relevance for hydrological, climatological and environmental research
12:00 – 12:20 ULRICH SCHWARZ – An extended method for continuous hydromorphological assessment applied in the Joint Danube Survey 3, 2013
12:20 – 12:40 ANNA KIDOVÁ, MILAN LEHOTSKÝ, MILOŠ RUSNÁK – Assessing the evolution of a gravel-bed braided river using geospatial techniques

12:20 – 14:00 **Lunch break**

Topic 4: Climate change, habitat change, hydromorphology
Chairpersons: MARIAN-TRAIAN GOMOIU, VESELA EVTIMOVA

14:00 – 14:20 MILOŠ RUSNÁK, MILAN LEHOTSKÝ **–** Flood related changes in stream channel morphology and bank erosion risk identification

14:20 – 14:40 KINGA FARKAS-IVÁNYI, GÁBOR GUTI – The effect of hydromorphological changes on habitat composition of the Szigetköz floodplain

Topic 5: Invasive alien species – early warning, priority species and pathways, risk assessment and management
Chairpersons: MARIAN-TRAIAN GOMOIU, VESELA EVTIMOVA

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15:20 – 15:40 TEODORA TRICHKOVA, MOMIR PAUNOVIĆ, MARIUS SKOLKA, LYUBOMIR KENDEROV, ZDRAVKO HUBENOV, VESELA EVTIMOVA, ALICE CARDECCIA, LUIS POPA, OANA POPA, JELENA TOMOVIĆ, KATARINA ZORIĆ, IVAN BOTEV – The Danube River as an invasive alien species corridor: The Lower Danube case study
15:40 – 16:00 HARALD KUTZENBERGER – IAS and infrastructure works – impacts, management and controlling

16:00 – 16:20 **Coffee break**

16:20 – 18:00 **Poster session**

Thursday, 19 June 2014

Topic 3: Ecosystem services, wetlands, sustainable use of biological resources
Chairpersons: MILAN LEHOTSKY, HRISTINA KALCHEVA

09:00 – 09:40 **Keynote lecture:** CHRISTIAN STEINER **–** Danube Working Community and its role in the EU Strategy for the Danube Region using the example of soil
09:40 – 10:00 ROUMEN KALCHEV, MARIA DINKA, MIHAELA BESHKOVA, HRISTINA KALCHEVA, ÁRPÁD BERCZIK, EDIT ÁGOSTON SZABÓ – Factors influencing the chemical characteristics and nutrient retention/ release potential of wetlands in the Middle (Hungarian) and Lower (Bulgarian) Danube River
10:00 – 10:20 STEFAN KAZAKOV, KÁROLY SCHÖLL, ROUMEN KALCHEV, LUCHEZAR PEHLIVANOV, ANITA KISS – Composition of zooplankton species diversity in Hungarian and Bulgarian sections of the Danube River
10:20 – 10:40 ERIKA SCHNEIDER – Aspects of wetland habitat restoration and monitoring in the Danube Delta: Water macrophytes as quality indicators in evaluation processes

10:40 – 11:00 **Coffee break**

Topic 9: Sustainable development and public participation in the Danube and Black Sea region
Chairpersons: HARALD KUTZENBERGER, TEODORA TRICHKOVA

11:00 – 11:20 GERTRUD HAIDVOGL – Historical change of Danube River fish communities and the interplay with fishery and habitat alteration – a case study for the Austrian river section

11:20 – 11:40 OANA IVAN – The "glorious" communist past and the "green" ecologic present: Anthropological perspectives over the Danube Delta fishing communities and their natural resource management
11:40 – 12:00 HARALD KUTZENBERGER – Environmental impact of wind power plants in Mühlviertel – first results and perspectives

12:00 – 14:00 **Lunch break**

14:00 – 14:40 **Keynote lecture**: GERTRUD HAIDVOGL, MARTIN SCHMID – Environmental history of the Danube River: Approaching a unique environment from a long-term, socio-ecological perspective
14:40 – 15:00 MARTIN SCHMID – How the Danube became the environment we know today: On the transformation of a socio-natural site since 1500
15:00 – 15:20 STEFAN DORONDEL, STELU SERBAN – A moving island: Nature dynamics and state borders' conflict for nature in modern Southeast Europe
15:20 – 15:40 MARIA BARAMOVA – Environmental impact of the war: Ottoman-European conflict along the Danube River in the Early Modern Time

15:40 – 16:00 **Coffee break**

16:00 – 18:00 **Session of General Assembly**

Friday, 20 June 2014

09:00 – 19:30 **Field trip – visit of the Rila Monastery and Iskar Reservoir**

09:00 Departure from Alexander Nevski Square (behind the Cathedral)
11:00 Arrival at the Rila Monastery
11:00 – 12:30 Sightseeing of the complex.
12:30 Lunch
15:00 Departure to the Iskar Reservoir
16:30 – 18:30 Visit of Iskar Reservoir with coffee-break
18:30 Departure to Sofia
19:30 Arrival at the Alexander Nevski Square

POSTERS

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

P1.01: AFANASYEV S., O. LIETYTSKA, O. MARUSHEVSKA – River re-naturalisation in the Tisza River basin after forest cutting activities

P1.02: CIOBOIU O. – The Danube River, essential factor in the distribution of freshwater gastropods within the faunistic provinces of Romania

P1.03: CURTEAN-BĂNĂDUC A., H. OLOSUTEAN – Using species-area curves technique to estimate the optimum number of samples for benthic macroinvertebrates

P1.04: ENGLONER A., Á. SZAKÁLY, D. SZEGŐ, V. KRIZSIK – Genetic diversity of reed stands developed in different water bodies of the Danube River

P1.05: GOMOIU M.-T., I. CĂRĂUŞ, G. OAIE – Comparative analysis of the phytoplankton population in the Lower Danube River in 2009-2011

P1.06: GYOSHEVA B., T. ISHEVA, P. IVANOV, V. VULCHEV – A pilot study of the Natura 2000 habitat 3260 along the downstream stretches of five Danube tributaries from the Bulgarian sector

P1.07: LIASHENKO A., K. ZORINA-SAKHAROVA – Macroinvertebrates of the marine edge and fore-delta of Kyliya branch of the Danube River

P1.08: LIASHENKO A., K. ZORINA-SAKHAROVA – The Influence of the invertebrate drift on the communities of the Danube Delta Marine Edge

P1.09: OLOSUTEAN H., D. M. ILIE – Prewintering aquatic and semiaquatic true bugs in the Timiş River valley (Romania): Adaptation, diversity and the role of human impact

P1.10: POPOVIĆ D., M. DJAN, L. ŠAŠIĆ, D. ŠNJEGOTA, D. OBREHT, A. VUJIC – Usage of different molecular markers in delimitation of cryptic taxa in *Merodon avidus* species complex (Diptera: Syrphidae)

P1.11: POTYÓ I., G. GUTI – Diurnal changes in fish assemblages in the Danube River section upstream of Budapest and its tributaries

P1.12: RADU E. – Diversity of macrophyte communities in the Danube Delta lakes in 2013

P1.13: RAKIĆ M., A. URBAN, M. KARAMAN – Macrofungi on driftwood in the Danube River arms of the „Donau-Auen“National Park, Austria

P1.14: STOIANOVA D., E. VARADINOVA, M. KERAKOVA, M. IHTIMANSKA, N. SIMOV, T. STEFANOV, V. TYUFEKCHIEVA, Y. VIDINOVA – Occurrence of the benthic water bug *Aphelocheirus aestivalis* (Heteroptera: Aphelocheiridae) in the Lower Danube River (Bulgaria) and its tributaries

P1.15: TARJÁNYI N., Á. BERCZIK – Spatial distribution of phytophilous macroinvertebrates in a side arm of the Middle Danube River

P1.16: VELIČKOVIĆ N., M. DJAN, E. FERREIRA, D. OBREHT, N. K. TUBIC, C. FONSECA – Does wild boar act as a pest species in Gornje Podunavlje Protected area – conclusions from genetic data?

P1.17: WEIPERTH A. – Analysis of structure, composition, spatial and temporal changes of juvenile fish community in a Danube-tributary system in the Middle Danube River Basin

P1.18: WEIPERTH A., I. POTYÓ, M. PUKY – Diet composition of the dice snake (*Natrix tessellata* Laurenti, 1768) (Reptilia: Colubridae) in the Danube River Catchment Area

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

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P3.02: KALCHEVA H., R. KALCHEV, M. BESHKOVA – Bacterioplankton of wetlands along the Lower Danube River (Bulgaria) and its relation to environmental factors

P3.03: PEHLIVANOV L., R. FIKOVA, N. IVANOVA, R. KALCHEV, S. KAZAKOV, M. PAVLOVA, S. DONCHEVA – Analysis of ecosystem services of wetlands along the Bulgarian Section of the Danube River

Topic 4: Climate change, habitat change, hydromorphology

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P4.02: WYHLIDAL S., D. RANK, K. SCHOTT, E. HASLINGER, O. PLANK – Short term isotopic signals in the Danube River water at Tulln (river km 1963) in 2012

P4.03: ZORINA-SAKHAROVA K., A. LIASHENKO, I. MARCHENKO – Effects of salinity on the zooplankton communities in the fore-delta of Kyliya Branch of the Danube River

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

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P5.02: PUKY M. – Invasive crayfish on land: *Orconectes limosus* (Rafinesque, 1817) (Decapoda: Cambaridae) crossed a terrestrial barrier to move from a side arm into the Danube River at Szeremle, Hungary

P5.03: TRICHKOVA T, R. LAUCERI, I. BOTEV, L. KENDEROV, Z. HUBENOV, V. EVTIMOVA, A. KOTSEV, I. GUARNERI, S. CALVARUSO, N. RICCARDI – Alien bivalve mollusk occurrence, population dynamics and impact: Lake Maggiore (Italy) and the Danube River (Bulgaria) case studies

P5.04: TUBIĆ N. K., M. DJAN, N. VELIČKOVIĆ, G. ANAČKOV, D. OBREHT – High genetic potential of invasive *Ambrosia artemisiifolia* L. populations in the Middle Danube River Basin

P5.05: VUKOV D., M. KRSTIVOJEVIĆ, M. ILIĆ, M. RUĆANDO, R. IGIĆ – *Cabomba caroliniana* A. Gray in the Canal Network in Serbia – influence on the plant species diversity and structure of aquatic vegetation

Topic 6: Water quality elements, ecological status, emerging pollutants, microbiology

P6.01: ÁGOSTON-SZABÓ E., K. SCHÖLL, A. KISS, Á. BERCZIK, M. DINKA – Decomposition of willow leaf litter in an oxbow lake of the Danube River at Gemenc, Hungary

P6.02: DONABAUM U., M. T. DOKULIL – Phytoplankton biomass and community structure along the River Danube

P6.03: KAZAKOV S., M. KERAKOVA, M. IHTIMANSKA – Ecological status of shallow lakes in the Bulgarian Danube River floodplain according to the ECOFRAME approach: Testing a system for integrated ecological quality assessment

P6.04: LIASHENKO V. – Assessment of water quality in the Ukrainian Part of the Danube Delta based on biotesting and bioindication of bottom sediments

P6.05: STOYANOVA T., I. TRAYKOV – Assessment of the ecological status of the Ogosta River, Northwestern Bulgaria, based on macrozoobenthos and general physical and chemical quality elements

P6.06: ŽIVKOVIĆ M., S. RADULOVIĆ, D. CVIJANOVIĆ, M. NOVKOVIĆ, A. ANĐELKOVIĆ, I. TEODOROVIĆ, P. BOON – The SERCON (System for Evaluating Rivers for Conservation) assessment of the Tamiš River

Topic 9: Sustainable development and public participation in the Danube and Black Sea region

P9.01: MARIN E., F. SELA, I. NICHERSU, M. MIERLĂ, C. TRIFANOV – Relations between local communities and sustainable management policies in the Danube Delta

P9.02: WINIWARTER V., G. HAIDVOGL – *Danube: Future* – A sustainable future for the Danube River Basin as a challenge for the interdisciplinary humanities

LECTURES

TOPIC 1: BIODIVERSITY – FRESHWATER, RIPARIAN AND FLOODPLAIN FLORA AND FAUNA, CONSERVATION, SOIL DIVERSITY AND PROTECTION

The influence of environmental variables on the structure and diversity of fish communities – A Carpathian river case study

DORU BĂNĂDUC, ANGELA CURTEAN-BĂNĂDUC

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This study analyzed the influence of biotope parameters, such as hydro-morphological characteristics, channel modifications, bank vegetation, riverine land use and physico-chemical parameters of water, on the structure and diversity of fish communities, in the case of the Timiş River (Danube Basin), as a basis for a sustainable management.

Quantitative fish samples were taken and biotope assessment was carried out on 21 stations along the Timiş River between its sources and the Romanian-Serbian border (241 km). The sampling programme was carried out in 2011.

A total of 32 fish species were identified, belonging to 27 genera and 9 families. The fish communities presented a high diversity along the entire sector of the Timiş River studied, as indicated by the high value of Jost alfa index (6.108) and by the value of Jost gamma index (17.292); the 2.831 value of Jost beta index revealed a relatively small structural variability.

Correspondence analysis (CA) revealed that high fish diversity was associated with alternating pools and clear-run sectors, river bed maximum depth and width, banks with natural dynamics and woody riverine vegetation. Principal component analysis (PCA) revealed that ichtyocenosis diversity varied in inverse proportion to concentration values of ammonium, nitrites and cadmium and to values of COD-Cr, COD-Mn and BOD5.

The results showed that to preserve the diversity of fish communities in the studied type of Carpathian river, it is necessary to preserve the natural morphodynamics of the river bed, limiting substrate exploitation, to preserve riparian tree vegetation and the water flows in a near to natural regime, to avoid water abstraction over some specific limits, and to avoid water pollution.

Key words: The Timiş River, fish communities, biodiversity, sustainable management.

Proposed section typology of the Danube River based on macroinvertebrates collected by different sampling methods

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An ordination of 50 Joint Danube Survey 2 (JDS2) sites (considered as less anthropogenic influenced) was performed in order to clarify how the individual sites are grouped according to faunal composition. The method of macroinvertebrate data collection was “kick and sweep” (K&S) in combination with dredging along the entire longitude of the river.

Results of centered PCA using log-transformed abundances (numbers of individuals) revealed five sections of the Danube River. Two distinct free flowing sections (gravel dominated Slovakian-Hungarian section and the Lower Danube after the Iron Gate Reservoirs) were recognized along with three other overlapping stretches (German-Austrian Upper Danube, Croatian-Serbian Middle Danube, together with the upstream Iron Gate section characterized by elevated water level). The sampling sites belonging to these sections were identified by convex polygons on the ordination plane. Practically, the same groups of JDS sites (sections of the Danube) were obtained when Mollusca and Crustacea were considered only. The result illustrated the outstanding relevance of these taxonomic groups to the typological characterization of the Danube River.

Further ordination of 22 subsequent sections was performed using summed qualitative and quantitative macroinvertebrate scores of the all 72 individual JDS2 sites. Data from the different sampling methods (air lift, K&S and dredging) were analyzed. The analysis was performed with all of the 255 taxa and with the data of the 58 Gastropoda, Bivalvia and Malacostraca taxa only. This was done in order to see how the typology of the Danube River was influenced by the different taxonomic groups. The results revealed four distinct types along the longitudinal dimension of the Danube River. The two most clearly recognizable distinct stretches were free-flowing sections, the gravel-rich Middle (Slovakian-Hungarian) Danube, and the Lower Danube after the Iron Gate Reservoirs. Considerable overlaps and strong faunal similarities can be detected between the upper (German-Austrian) and the Iron Gate I. Reservoir sections, most probably due to the anthropogenic effect of the hydroelectric power plant dams and elevated water level.

Key words: Macroinvertebrates, multivariate analysis, section typology.

TOPIC 2: PROTECTION AND REHABILITATION OF DANUBE STURGEONS

Can anadromous sturgeon populations be restored in the Middle Danube River?

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The decline in migratory fish species has been particularly marked in diadromous species, which require different environments for the main phases of their life cycle, and moving between the key environments is essential for them to survive. All of the anadromous sturgeon species are critically endangered in the river system of the Danube basin. Action plans and program proposals have been worked out since the beginning of the 21th century with the aim to draw attention to the serious situation of sturgeon populations and convey the urgency of remedial measures to the public and policy makers. Conservation of sturgeon populations is a highlighted effort in the EU Strategy for the Danube Region and the relevant urgent tasks and requirements are described in the program "Sturgeon 2020". The major threats for the anadromous sturgeons in the Middle Danube River are the historical over-exploitation of populations, the loss of spawning habitats, the interruption of migratory routes between the key habitats, etc. Sturgeons are a flagship species for the ICPDR, because their occurrences indicate the ecosystem health and a range of restoration successes, such as improvements of river morphology, longitudinal connectivity and water quality in the Danube River and its major tributaries. Recovery of the over-exploited sturgeon populations in the fragmented and altered river systems, as the Danube, is a complex issue and a difficult problem to solve. The expected impacts of some often suggested in-situ conservation measures are evaluated with regard the efficiency of fish pass facilities at hydropower dams, the estimation of survival rate of sturgeon populations and the assessment of stock-recruitment from artificial propagation.

Key words: Overfishing, river fragmentation, Iron Gate dam, spawning migration, homing, stocking.

Past and current investigations of sturgeons in Serbia – analysis of critical gaps that should be resolved to achieve their successful conservation

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The importance of sturgeon species on the territory of the Republic of Serbia dates back to the Neolithic age. First reliable descriptions of sturgeon fishery in the Danube come from the end of the XIX and the beginning of the XX century. These sources also described river bottom modification efforts made with the aim to improve conditions of the Danube river navigation, and they already mentioned negative influences of those activities on sturgeon migrations. Later research activities, conducted during 1948-1954 in the Danube section between 886 and 944 river km, were focused on the commercial fishery of all six Danube sturgeon species. More detailed analyses of sterlet (*Acipenser ruthenus*) were conducted in 1956. Following this period, there were only individual investigations of sturgeons, made within ichthyofaunistic assessments, until 2001 when recent research activities were initiated. These investigations comprised analyses of contamination levels of heavy metals and other pollutants in sterlet tissues, hystopathological analyses and genotoxicity tests. Furthermore, research activities were also focused on molecular genetics analyses of sterlet populations in Serbia, as well as on the analysis of historic catch data and the population modelling of Danube sturgeon species. Although sturgeons used to represent valuable objects of commercial fishery due to a high price of their caviar, and sterlet is nowadays still an important species for commercial fishery, there is a lack of data on their spawning, nursing and overwintering habitats, which obstructs development of adequate protection measures. Moreover, there are no estimations of the abundance of sturgeons that make upstream spawning migrations up to the Djerdap II dam, as well as of their spawning success. Taking into consideration substantial presence of illegal sturgeon fishery, all above described impacts hinder efficient protection and management of sturgeon species, which will require intensified international cooperation, in addition to activities on national level.

Key words: Historical data, commercial fishery, ecotoxicology, molecular genetics, population modelling, critical research topics.

TOPIC 3: ECOSYSTEM SERVICES, WETLANDS, SUSTAINABLE USE OF BIOLOGICAL RESOURCES

Factors influencing the chemical characteristics and nutrient retention/ release potential of wetlands in the Middle (Hungarian) and Lower (Bulgarian) Danube River

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Several chemical variables including nutrients (N- and P-forms) of wetland waters were measured and analyzed. The investigations covered 5 water bodies belonging to the Middle Danube and presented by about 30 sampling sites, and 6 other wetlands belonging to the Lower Danube each presented by a single sampling site. Additionally, samples from the Danube River at river km 775 and 1498 were taken and analyzed correspondingly.

The spatial distribution patterns of nutrient compounds in wetlands of two Danube regions as well as their ability to retain nutrients were derived and compared.

The trophic status presented by phosphorus and nitrogen concentrations showed values in the range of hypertrophy with exception of 1-2 Bulgarian wetlands showing lower nitrogen concentrations. Several hydrological (river water level, flow availability and direction), morphological (distance to the main river channel, isolation from the river, type of wetlands depth of sampling sites etc.) and physical (water temperature) variables were analyzed and their effects on spatial changes of measured chemical variables in wetlands of two river regions were tested.

The belonging of wetlands to plesiopotamal, the percentage of water area covered by macrophytes, and the availability of stream outflow determine the spatial ordination of chemical data in the Hungarian river stretch, while the belonging of the Bulgarian wetlands to river, lake or canal type was decisive for the separation of registered chemical data.

The same variables (percentage of macrophytes and outflowt of water) influenced statistically significantly the ratios calculated between nutrient concentrations in wetlands and the river in the Middle Danube, while the percentage of macrophytes was the single variable responsible for spatial variations of the same nutrient ratios calculated for wetlands of the Lower Danube.

Key words: Chemistry, wetlands, the Middle and the Lower Danube River, multivariate analyses.

Composition of zooplankton species diversity in Hungarian and Bulgarian sections of the Danube River

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Zooplankton communities in the main arm of the Middle and Lower Danube and in 15 adjacent wetlands were compared. The investigated sites belong to the Bulgarian and the Hungarian Danube stretches. Different kinds of wetlands are presented in the compared sections of the Danube. In the Middle Danube, they are situated in the active floodplain representing braided side-arms passing through different stages of hydrological connection, while most wetlands in the Lower Danube floodplain are more or less isolated from the main channel by the river embankment and influenced by the Danube's hydrological regime mainly through underground infiltration and sluice regulation facilities.

Zooplankton was investigated in the Hungarian wetlands from 2002 to 2004, from 2007 to 2009, and from 2012 to 2013, and in the Bulgarian wetlands - from 2009 to 2012. Clustering analysis based on the species composition was used to show the similarities between the investigated zones. Frequency of species occurrence was compared in the different types of wetlands.

Over 202 species were identified and their spatial distributions were compared. The richest species composition was found in the Nyéki-oxbow and Rezéti-Danube in the Hungarian floodplain and in the wetlands Orsoya and Kalimok-Brashlen in the Bulgarian floodplain, respectively. Crustaceans *Chydorus sphaericus* of Cladocera and *Eucyclops serrulatus* of Copepoda occured in all the studied wetlands and also in the main Danube channel. The most frequent species of Rotifera were *Brachionus diversicornis, Brachionus quadridentatus, Euchlanis dilatata,* and *Keratella quadrata*.

Key words: Zooplankton, species composition, Middle and Lower Danube River, wetlands, floodplain.

Aspects of wetland habitat restoration and monitoring in the Danube Delta: Water macrophytes as quality indicators in evaluation processes

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During the second half of 20th century, particularly in the last three decades, large scale drainage and transformation of wetlands into agricultural lands and fishponds took place in the Danube Delta. Severe consequences of the human impact became visible shortly after with changes of the hydrological regime in certain areas, related hydro-morphodynamic processes, salinization and steppization of the drained areas, the loss of many site typical macro- and microhabitats and important wetland ecosystem services. Beginning with the year 1990 a change of thinking took place and lead to the start of large scale proposals for restoration projects. Following first discussions and plans, a large international pilot project started with the restoration of two embanked areas, the agricultural polders Babina and Cernovca (Romania), followed by three additional restoration projects. Applied research has been conducted on all of these to monitor the project results.

The aim of the study is to present the results of a long term monitoring on water macrophytes, used as quality indicators on four restoration areas in the Danube Delta/Romania, to discuss the development of these areas under the restored hydrological regime, to analyse and to discuss the results of the measures in terms of habitat restoration and wetlands ecosystem health. Problems, solutions and perspectives of these areas are discussed and key ecological factors for the functioning of the ecosystem are highlighted, being crucial for a sustainable use by the local communities.

Key words: Wetland restoration, Danube Delta, water macrophytes, quality indicators, monitoring, evaluation.

TOPIC 4: CLIMATE CHANGE, HABITAT CHANGE, HYDROMORPHOLOGY

The effect of hydromorphological changes on habitat composition of the Szigetköz floodplain

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Several structural and functional deficiencies of altered river ecosystems (areal decline of aquatic habitats, change of bed load transport, decrease of lateral river-floodplain connectivity, etc.) can be recognized by analysis of historical maps, changes in water regulation and development of land-use.

Impacts of river engineering, particularly effects of channelization were studied in the Szigetköz floodplain of the Danube. Different hydro-morphological situations at three study sites were investigated in the active floodplain. Results indicated some differences in landscape dynamics from the pre-regulation period until recently, after the extensive river engineering. Changes in longitudinal and lateral connectivity of river-floodplain ecosystem were analysed by historical maps from the late 18th to the early 21th century.

Prior to extensive regulations, the Szigetköz floodplain was a highly dynamic alluvial anabranching channel system. Alteration of hydro-geomorphological processes by engineering lead to aggradation of river-floodplain ecosystem, formation of several abandoned channels and significant decline of the ecological rejuvenation of the aquatic habitats.

Key words: Landscape history, landscape ecology, human impacts, river engineering.

Assessing the evolution of a gravel-bed braided river using geospatial techniques

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GIS-based multi-temporal analysis of aerial photos (seven time periods: 1949, 1961, 1973, 1986, 1992, 2003, and 2009) document the spatial and temporal changes in vegetation cover of the braided Belá River system. The number of landforms (island attached, bank attached bars and central bars) and three types of vegetation cover (a) non-vegetated (less than 10 %), (b) sparse vegetation (less than 50% of shrub and herbaceous cover) and (c) dense vegetation (more than 50% of shrub and herbaceous cover) were identified. The landscape metrics were computed in FRAGSTAT software. During 1949-2009 the non-vegetated central bars dominated, while only few bars were covered by dense vegetation. This seems to evidence the relative stability of the braided planform type. However, the analyses showed a decrease in vegetation cover on central bars and an increase of number of attached bars covered by dense vegetation. The linkage between vegetation cover and channel landforms indicates the in-channel succession of vegetation and reflects a decreasing trend in active channel area, channels narrowing and river bed incision. This is the consequence of river channelization and aforestation of the Belá River watershed between 1957 and 2008 and reflects the general degradation of the former braided planform.

Key words: Evolution, braided, GIS, multi-temporal, degradation.

A 50 years' isotope record of the Danube River water and its relevance for hydrological, climatological and environmental research

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The isotope ratios of hydrogen and oxygen in the Danube water at Vienna have been measured since 1963 (^{3}H, stable isotopes ^{2}H and ^{18}O since 1968). This is probably the worldwide longest isotope record of a large river. From the ^{2}H-^{18}O relation ("deuterium-excess") can be concluded that the isotopic composition in the Danube water mainly reflects the isotopic relations in precipitation in the catchment area with some delay due to the residence time of precipitation water in the catchment. The advantage of river water sampling in comparison to precipitation sampling is that the isotopic composition in river water represents the whole catchment area. It allows drawing hydro-meteorological conclusions on a larger scale based on a relatively small number of measurements. The stable isotope time series shows significant changes in a decadal scale, e.g. a remarkable increase of $\delta^{2}H$ and $\delta^{18}O$ in the 1980ies mainly due to rising environmental temperature. Since 1952, the ^{3}H content of precipitation has been dominated by the ^{3}H releases of nuclear weapon tests. As a consequence, the ^{3}H concentration of precipitation increased by about a factor 1000 in 1963 (maximum) followed by a continuous decrease. During the last decade, ^{3}H values have approached "pre-bomb" levels again. From this ^{3}H record, a mean residence time of about 3 years of precipitation water in the Danube catchment upstream of Vienna can be calculated (mainly base flow). A similar value can be found by using the climatological signal of stable isotope time series. Since about 1995, short-term ^{3}H elevations due to releases from nuclear power plants have been detected. Such ^{3}H peaks can be used to study travel time and dispersion (mixing) of contamination pulses in the Danube. In order to obtain an isotopic database for the entire Danube Basin, the Danube water sampling at Tulcea (delta region) was established in 2009.

Key words: Isotope hydrology, climate change, Danube River, deuterium (^{2}H), tritium (^{3}H), oxygen-18 (^{18}O).

Flood related changes in stream channel morphology and bank erosion risk identification

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The article deals with the effect of extreme flood events on lateral channel shift and bar pattern with relation to changes of the riparian zone land cover structure by using multi-temporal analyzes of aerial photographs (three time horizons - 1987, 2002 and 2009) in the GIS environment on the example of the 13.2 km long less regulated and laterally partly-confined meandering reach of the Ondava River (Eastern Slovakia). The photographs were chosen in a way to capture the morphological changes that occurred after floods. The average lateral channel shift per year was 1.17 m in 1987 – 2009, maximum 217 m. The river has eroded in total 35.6 ha and deposited 31.6 ha. Gravel bars in 1987, 2002 and 2009 spread a channel total area of 21.1 ha, 17.8 ha and 19.7 ha. The most eroded category is that of arable land, followed by grasslands and pastures and shrubs. We conclude that in case of the Ondava, frequent small floods, instead of causing destruction of the system, led to the stabilization of the channel, erosion of the concave bank and to the formation of the meandering planform. In contrast, the short recurrence interval of extreme floods led to an increased intensity of erosion processes, a change of the meandering planform to slightly braided one, straightening of the channel and formation of gravel bars.

Key words: Bank shift, flood, multi-temporal, GIS.

An extended method for continuous hydromorphological assessment applied in the Joint Danube Survey 3, 2013

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Based on the experiences of the ICPDR - JDS2 (from 2007) hydromorphological survey and extended requirements within the CEN framework standards, the JDS3 was re-assessing the hydromorphological features on a better spatial scale (instead of individual stretches between 30-50 rkm, now by constant 10 rkm segments) and introduced first time a basic sediment characterisation in longitudinal as well as cross sectional direction.

The disadvantage of the hydromorphological overview methods for large rivers is the invisibility of the channel bed. Therefore it is affordable regarding the substrates as core habitat parameter for Biological Quality Elements, the morphodynamic parameters as required under the WFD and the hydromorphological intactness regarding long-term channel developments (channel incision by sediment deficit) to have a better insight what appends on the river bed, in the shallow bank zone and at tributary confluences (sediment characterisation and flow velocity survey). Therefore, this JDS3 includes for the first time a comprehensive analysis for bed (-load) sediments relevant for morphology and further offers professional flow velocity and suspended load measurements performed by Water Research Institute Bratislava (VUVH).

The description and evaluation of hydromorphological characteristics for large rivers (including hydromorphological reference conditions) is strongly dependant on various background data such as historical, topographical and navigation maps, satellite images, hydrologic and morphometric as well as landuse data.

This article focuses on the first results of the hydromorphological assessment (channel, banks, and floodplains) and introduces hydromorphological reference conditions as relevant for the Danube and its typology as required for biological assessments.

Key words: Hydromorphology, JDS 3.

TOPIC 5: INVASIVE ALIEN SPECIES – EARLY WARNING, PRIORITY SPECIES AND PATHWAYS, RISK ASSESSMENT AND MANAGEMENT

IAS and infrastructure works – impacts, management and controlling

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Species have several different conditions that make them to become invasive alien species. Biogeographic changes and population dynamics are important factors as well as climate change and human impacts. Relevant human impacts are infrastructure works in sensitive areas that increase the range of distribution and create corridors for further expansion.

This influence is especially relevant in active floodplain landscapes like the national park Donauauen downstream Vienna. Also side effects of infrastructure construction works can have relevant impacts on the expansion of invasive alien species.

On the example of a highway construction work along the border of the national park Donauauen management and conflicts are described and discussed. A highway section of seven kilometres between Vienna airport and Fischamend is renewed and enforced. As this section follows the border of the national park very close, potential impacts need control during the ongoing implementation phase. So special surveillance on the ecological aspects takes place during the whole period of implementation and avoids potential conflicts that also include invasive alien species: violation of soil surfaces during tree clearing works with creation of germination conditions, risk of introduction of soil from outside the construction site with seed infection, risk of introduction of seed infection by construction vehicles. In this connection the focus lies mainly on introduced plant species like *Acer negundo, Solidago canadensis* and *Impatiens glandulifera*. These species have already wide regional distribution and can easily occupy new sites.

Another potential source of conflicts lies in the reforestation period. An ecological planning and tender procedure have been done, but it often happens that there are differences between plant lists and numbers of the tender and the delivered plants at the construction site.

At the same time the national park management aims to lead the tree community to more natural biocoenosis again and reduce the amount of *Acer negundo*. Therefore, continouous control is necessary to make sure that no negative impacts that can be avoided take place.

Key words: Invasive alien species, *Acer negundo, Solidago canadensis, Impatiens glandulifera*, construction works, highway, Danube River floodplain, national park Donauauen.

The Danube River as an invasive alien species corridor: The Lower Danube case study

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Among the four principal aquatic invasion corridors in Europe, the Southern corridor links the Black Sea basin with the North Sea basin via the Danube–Main–Rhine Canal. This complex waterway facilitates an intensive dispersal of previously geographically isolated taxa in both northwest and southeast directions throughout the Danube River basin. In most of the cases of introduction and establishment of aquatic alien species through the Danube River, negative impact was reported, such as changes in biodiversity and communities, alterations of the food webs and ecosystem services. The first records of alien taxa in the Lower Danube date back to the beginning of 20th century. Considering the modes of arrival, intentional and unintentional introduction are assessed as of equal importance. The dominant pathways of introduction include stocking, range expansion, aquaculture, shipping and ornamental. In this study, we present a review of aquatic alien species, including species lists, data on recent introductions, pathways, population status, habitat requirements, invasiveness and potential impact, based on a case study of the Lower Danube River (Serbia, Bulgaria, Romania).

In the Serbian-Romanian stretch of the Danube River, we found 17 macroinvertebrate, 16 fish and 10 vascular plant alien species. Among the alien macroinvertebrate taxa recorded, molluscs and crustaceans were found to be the most prospective invaders. Five alien species of Bivalvia, one Gastropoda, six Amphipoda, two Mysida and two Decapoda were reported up to now. All of them can be considered as invasive. Among the 16 fish species recorded, eight are considered as invasive and two species as potentially invasive. In the Bulgarian-Romanian and Romanian stretch of the Danube River, including the Danube Delta, three alien species of Bivalvia, one Decapoda, one Kamptozoa, one Bryozoa, one Oligochaeta, and 12 alien fish species were recorded. Among the alien macroinvertebrates, the most successful invaders were the bivalve molluscs, of which *Corbicula fluminea* was the most frequently found and most abundant during our study. In the littoral area of the Bulgarian stretch, the most frequently found alien fish species were *Pseudorasbora parva*, *Syngnathus abaster* and *Lepomis gibbosus*, and the most abundant was *C. gibelio*, followed by *S. abaster*. The results were analyzed and discussed in terms of alien species population dynamics, habitat requirements and potential impact on native aquatic communities.

Key words: Aquatic invasive alien species, pathways of introduction, abundance, potential impact, Lower Danube River.

Acknowledgements: This study was supported within the frames of the East and South European Network for Invasive Alien Species (ESENIAS) and the International Association for Danube Research (IAD).

TOPIC 6: WATER QUALITY ELEMENTS, ECOLOGICAL STATUS, EMERGING POLLUTANTS, MICROBIOLOGY, ECOTOXICOLOGY, BIOMONITORING AND SAPROBIC SYSTEMS

Phytoplankton of the Danube River: Composition and long-term dynamics

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Investigations on river phytoplankton in the Danube are summarised and placed into a historic perspective. Phytoplankton species composition always has been dominated by diatoms, particularly centric taxa. Longitudinal, seasonal and long term dynamics are described and their implications are discussed. Factors responsible for the wax and wane of phytoplankton growth in the middle section of the River Danube are analysed and discussed. Survival, growth and production of phytoplankton in the Danube and in large rivers in general are then incorporated and integrated into the existing fundamental concepts of riverine ecosystems.

Key words: Phytoplankton, chlorophyll-a, species composition, dynamics.

Ecological assessment based on benthic diatom and macroinvertebrate communities in the Bulgarian section of the Danube River

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The Danube River is the second largest in Europe and 19 countries belong to its catchment. Several significant pressures have been identified within the Danube River Basin: organic, nutrient and hazardous substances pollution, as well as hydromorphological alterations, invasive alien species, etc. (The Danube River Basin District Management Plan 2009). They could affect the benthic communities. The aims of our study were to monitor the diversity and distribution of littoral diatoms and macroinvertebrates and to assess the ecological status based on selected metrics of the benthic communities in the Bulgarian section of the Danube River. The taxonomic and trophic community structures, including dominant and invasive alien taxa, were studied in order to select the most appropriate metrics and biotic indices for the assessment.

A total of 12 river sites were sampled from Vrav (839 rkm) to Ryahovo (468 rkm) in September 2012 and September 2013. Epilithic diatoms were collected by washing the upper surface of stones using a brush and distilled deionised water, while benthic macroinvertebrates were collected by using the multihabitat sampling approach with hand-held net.

We found more than 250 diatom taxa in the epipelon. Common, cosmopolitan, meso- to eutrophic diatom taxa dominated in the investigated diatom flora. The highest number of species was observed at Svishtov, the poorest diatom assemblages were determined in the samples from Belene and Kozloduy. Macroinvertebrate communities were dominated by Bivalvia, Gastropoda and Amphipoda. A comparison with previous studies in the Danube River (1960–1980s) revealed that benthic communities had changed dramatically owing to the spread and increase of densities of alien taxa (*e.g. Corbicula fluminea, Anodonta woodiana*) and significant reduction in the densities of native species (*e.g. Unio crassus* and *Teodoxus transversalis*). Changes in the qualitative and quantitative composition of the benthic communities were considered in the selection of the metrics for the assessment of the ecological status of the river. Possible reasons for the unfavourable changes were discussed.

Key words: Danube River benthic communities, native and alien species, abundance, trophic structure, ecological quality.

Acknowledgements: This study was supported within the frames of the East and South European Network for Invasive Alien Species (ESENIAS) and the International Association for Danube Research (IAD).

Preliminary results on the distribution of macrozoobenthos along the Bulgarian stretch of the Danube River with respect to loading of nutrients, heavy metals and arsenic

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The Lower Danube, being an important navigable way, is recognized as a heavily modified water body according to the Water Framework Directive criteria. The shoreline zone is subjected to various anthropogenic pressures (such as discharge of organic substances and nutrients, continuity interruption, gravel abstraction, rip-rap armouring etc.), which affect the aquatic communities.

This present study represents the distribution of the main macrozoobenthic groups at 16 sites along the Bulgarian shoreline zone of the Danube River, provisionally identified as influenced by different pressures. The relationship between the longitudinal distribution of macrozoobenthos and the content of some pollutants in both the water and sediment was studied. Fourteen sampling sites were located downstream major tributaries, cities and harbours and 2 other sampling cites were considered relatively less influenced. The abundance of amphipods, oligochaets and chironomid larvae increased downstream along with the load of nutrients in the water and sediment. Less abundant taxonomic groups like Ephemeroptera, Hirudinea and Diptera (varia) were also better represented at the lower sampling sites. The gastropods were more or less evenly distributed along the Bulgarian Danube section while Bivalvia seemed to be more abundant in its upper part. As a whole, the content of Ni, Fe, and Pb in both the sediment and water were higher at the sites along the lower part of the Bulgarian stretch (to the East of the Iskar River confluence), while higher concentrations of Cu and As were found at the sites upstream the Iskar River.

Key words: The Lower Danube, macrozoobenthos, heavy metals, Water Framework Directive, nutrients.

Assessment of fish stocks and elemental pollution in the Danube, Sava and Kolubara Rivers on the territory of the city of Belgrade, Serbia

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There is a lack of adequate estimates of fish stocks in the area of the city of Belgrade, Serbia, as well as of the current fishery pressure on fish diversity and of the contamination level of fish meat. These factors obstruct efforts to conduct valorisation of the current state and potential development of this resource. During 2012 and 2013, an assessment of the current state of fish resources in Belgrade fishery waters was performed, in order to establish a good basis for the development of a monitoring system on the state of fish stocks and their exploitation. Fish samples were collected on eight localities on the Danube, the Sava and the Kolubara rivers. Fish stock composition and biomass were determined on each of the localities. Results indicate that the commercial fishery on the Danube and Sava rivers is characterized by seasonal variability regarding the amount and the composition of fish catch, while the ratio of high versus low quality fish remained relatively stable over time. In most of the analyzed fish, heavy metal concentrations remained below the prescribed maximum allowable concentrations (MAC). However, concentrations of mercury, cadmium and zinc exceeded MAC in the tissues of a number of individuals of Wels catfish, common carp, sterlet, pikeperch, European perch, ruffe and sichel, which indicates that the meat of Danube fish species can be utilized in human diet only in limited quantities, and that it is necessary to establish permanent monitoring of heavy metal concentrations in this area. Based on results, a system of indicators was defined and a monitoring system for the Belgrade fishery waters was proposed. Pike-perch and freshwater bream were selected as major species for fish meat quality monitoring, while the implementation of fishery monitoring program should comprise both economically important fish species and certain nonindigenous species.

Key words: Fish stock, monitoring, fishery, heavy metals, Danube River, Sava River.

Application of morpho-functional classifications in the evaluation of phytoplankton changes in the Danube River

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The traditional taxonomic approach is being supplemented today by ecological classifications of phytoplankton resulted in three morpho-functional classifications: functional group (FG), morpho-functional group (MFG), and morphology-based functional group (MBFG) concepts. Current research is focusing on the verification of their reliability for implementation in different freshwater ecosystems. In this review, we compared the application of all three concepts in the phytoplankton monitoring of the Danube and its floodplains, currently restricted to its middle section. Diatoms are recognised as the most abundant representatives of the potamoplankton and are an important link between river and floodplain habitats in conditions of flooding. According to the FG classification, diatoms were distributed into seven groups defined by their environmental preferences, among which the dominant codons in the Danube are C, D, and T_B. Centric diatoms such as *Cyclotella meneghiniana* (C group) and *Stephanodiscus hantzschii* (D group) are typical and permanent potamoplankton species, while during high-discharge periods tychoplanktonic diatoms (T_B) can become dominant. Relations of the D and T_B groups with strong mixing events distinguished them as characteristic for flooding phases in floodplain habitats. The MFG classification separated diatoms into four groups (large or small centrics or pennates). Different temperature requirements and sensitivity to flushing are found to be the key driving factors for the successions of dominant species within small centrics, indicating that small centrics sorted into only one group cannot clearly reflect environmental changes. The most limited effectiveness was exhibited by the MBFG classification, whereas all diatom taxa are sorted into a single group (GVI). Altogether, it is obvious that a fine partition of phytoplankton taxa within the functional classification enables a more satisfying description of potamoplankton changes. Further investigations must be focused on longitudinal changes of phytoplankton along the Danube as a consequence of specific adaptations to existing hydrology and the physicochemical environment.

Key words: Phytoplankton, Danube River, ecological classification, diatoms.

Effect of some environmental parameters on the composition of fish communities in the riparian zone of the Bulgarian Danube River section

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Sixteen sites along the Bulgarian Section of the Danube were surveyed in August and September 2013. Fishes were sampled using portable electricity fishing device and seine net. Basic physical and chemical parameters (water temperature, dissolved oxygen and saturation, pH, COD, conductivity, concentrations of ammonium, nitrate, nitrite nitrogen, phosphate phosphorus; total nitrogen and phosphorus) of both the water and sediments were measured. Some other abiotic (composition of the substrate) and biotic factors (percent macrophyte coverage, chlorophyll a concentrations) were also in use. The concentrations of heavy metals (Cd, Mn, Cu, Pb, Zn, Ni,) and the As in the water and in the sediments were also examined according to the standardized methods. Statistical packages Canoco 4.5 and Primer v 6 were used. A total of 22 fish species were found. The analysis of the number-to-biomass ratio showed significant pressure on the fish community. Multivariate tests indicated the cumulative effect of the natural and anthropogenic factors. The percent coverage of macrophytes, temperature, and the substrate features were identified as the main natural factors for the distribution of fish. The concentration of As, Ni, Mn and the content of nitrates in the river sediment were found to be the leading anthropogenic factors. Further studies on the ichthyofauna are necessary regarding the high importance of the habitats in the riparian zone for the surviving and growing of the young fishes.

Modelling of aquatic primary production patterns in the Danube River floodplain Lobau

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Surface water quality models are widely used to simulate and predict nutrient availability and primary production patterns in aquatic ecosystems. Particularly, in highly heterogeneous systems like river-floodplain-systems, process-based models can be useful tools to compute trophic development and their ecological significance.

The Lower Lobau, former floodplain of the Danube River southeast of Vienna, represents today a back-flooded lake system mainly decoupled from the main stem. Nutrient availability and in consequence the aquatic primary production depends on hydrological exchange conditions with the main channel of the river as well as on internal release processes at the water-sediment boundary layer.

Potential restoration measures aiming at the improvement of lateral connectivity of the floodplain are supposed to have a major impact on the cycling of matter and the role of sediments. In order to predict the development of water quality for different management scenarios, we adapted a dynamic water quality model. WASP7 (Water Quality Analysis Program by US EPA) is a widely used dynamic compartment-modelling program for aquatic systems including both the water column and the underlying sediment. Linked with a hydrodynamic transport model which provides flows, depths and current velocities, the model computes limnochemical conditions, nutrients and algal primary production under varying hydrological and seasonal conditions. This enables us to predict spatially explicit the trophic development and hotspots of biogeochemical metabolism.

Key words: Water quality modelling, ecosystem functions, Danube River, floodplain.

TOPIC 8: RIPARIAN LANDSCAPES, LANDUSE, FLOOD RISK ASSESSMENT, HYDROLOGICAL MODELLING AND RESTORATION

Carbon and nutrient dynamics in highly altered riverine landscapes of the Danube River: Importance of scaling

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Riverine landscapes have a strategic role in biodiversity aspects and biogeochemical cycling in intensely used catchments and can provide multiple functions and services of importance for human well-being. The alteration of riverine landscapes has led to increasing efforts in water management, also concerning rehabilitation and restoration activities, especially in areas of high nature value. The floodplain stretch of the Danube River downstream Vienna for example has undergone severe changes by mainly altered ground- and surface water connectivity in the last 20 to 140 years which result in various alterations including changes in biogeochemical cycling at different scales. In order to estimate the effects of different management options related to conservation and restoration and to compare the situation in restored and degraded floodplain systems, carbon and nutrient dynamics as key ecosystem properties and functions were analysed. We demonstrated that principles of hydromorphological dynamics acting at different scales control potential greenhouse gas emissions and the nutrient status in the water column and sediment compartments, and these could be used as proxies to assess environmental changes in riverine landscapes. Changes in hydromorphology as introduced by restoration measures can have effects at multiple scales and may stimulate nitrogen turnover, and they can even reduce greenhouse gas emission of nitrous oxide compared to degraded floodplain systems. The results clearly showed that increasing hydrological connectivity could impact various ecosystem properties and ecosystem services and these effects have to be considered in a sustainable management approach.

Key words: Ecosystem restoration, ecosystem functions, Danube River, biogeochemistry.

Riparian zone land cover: Classification, changes and trends of development

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The study aims to classify the riparian zones situated in agricultural areas, to analyse their changes and evolutionary trends, based on the comparison of their land-cover pattern in two time horizons - 1987 and 2003, at three scales - national (all Slovak rivers situated in agricultural landscape), river segment (35 km long, 50 m wide areas of the Torysa river), and river reach (4 Torysa reaches, 4–8 km long, 50 m wide). Based on analyses of aerial photographs, zones at the national level were classified into 4 land-cover classes, and at the segment and reach scale – into 13 land-cover classes in each time horizon. The land-cover map of Slovakia (2006) was the source for the identification of four types of the areas adjacent to the riparian zones as potential drivers which control the development of zones land-cover pattern. Using gathered information made it possible to reveal trends in riparian zones land cover evolution and to interpret its scalar variability as the result of effects exerted by the drivers governing in the planned (1987) and free-market economy (2003), as well as natural ones. In general, the results show that the proportion of shrubs and forest increased at the cost of grassland, pioneer vegetation and bare surfaces. At the national level, zones with disconnected and continuous riparian vegetation exhibit the progressive trend characterized by increasing zone width and bulkiness. Lowland riparian zones without vegetation cover and that with distinctly unconnected vegetation linked with the system of canals exhibit stagnant trend. Riparian zones along large Slovak rivers (the Váh and the Hron) that might become strip corridors required an active approach to their rejuvenation. While the farmland intensification in the distal part of the riparian zones at segment and reach scales increase, extensive management of their proximal parts decrease, i. e. succession of alluvial forest close to river channel is evident.

Key words: Riparian zone, land cover, classification, changes, development.

Links between selected environmental components and flood risk in the Danube Delta

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The Danube Delta is the third largest delta in Europe after the Volga's Delta and Kuban's Delta. It is part of the Danube Delta Biosphere Reserve together with Razim Lagunar Complex and the Danube Floodplain upstream the delta. It is localized in the South-East part of the Romanian territory. The main components (as extent and importance) are various water bodies. Water is the vital element for the people that live in delta, as it is used first of all in direct consumption, and then it offers the habitat for the major resource of the delta, namely: the fish. Water is also used for irrigation. In the same time, water could be a permanent threat if we are referring to socio-economic part of the environment. The flood risk is the most important issue affecting human activities. In order to have a better management of the environment components, it is useful to analyse the relations between them and the flood risk. The paper presents a few elements of the environment like soil, land morphometry, land use, biodiversity in the Danube Delta in direct relation to the flood hazard and flood risk. Once the relation between these environment elements and the flood risk are known, mitigation measures can be proposed in order to reduce or to eliminate the vulnerability of the elements to flooding. This can be included in the flood risk management plans that should be part of the spatial planning process in all areas, but especially in areas close to water bodies (stagnant or running waters).

Key words: Danube Delta, flood risk, environment elements, risk management.

The Danube River in 1837 – the Demidoff expedition

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In 1840, the first edition of the book *Voyage to Southern Russia and Crimea, through Hungary, Wallachia and Moldavia in 1837* was published in Paris. The book describes the voyage of 12 people who studied, sampled and conserved animals and plants and made drawings and notes of everything they encountered, from people and habits to nature, wildlife and landscapes. From Budapest to Giurgiu the expedition travelled along the Danube River, being financed and conducted by Prince Anatole Demidoff. Nature and landscape, people and culture were recorded with talent and thorough attention to details by the expedition members (including three engineers, two geologists, a mineralogist, a zoologist and palaeontologist, a botanist, a photographer and an illustrator and lithographer).

Other 3 volumes related to the expedition were published in 1842 on studies of anthropology, botanic, geology and palaeontology, studies on Pontic fauna, and results of geology exploration in the Donets Basin. These three books were accompanied by an album containing 78 colour plates, executed at the Natural History Museum and coordinated by the Finnish zoologist and palaeontologist Alexander von Nordmann. The plates show mammals, reptiles, birds, fishes and molluscs, each illustrated with great accuracy and a unique sense of colour. The botanist of the expedition recorded several types of fungi, including those affecting plants.

In 1848, another album published in Paris illustrated the 1837 Demidoff expedition in 100 lithographs after the drawings of Auguste Raffet. Among the lithographs, there are detailed illustrations of the landscape along the Danube, landscape that has changed considerably since 1837 mainly due to human intervention.

This paper traces the steps of the Demidoff expedition along the Danube, in order to highlight the main changes in landscape and nature as compared to the famous illustrations of Raffet.

Key words: Landscape, nature, Auguste Raffet, lithograph.

TOPIC 9: SUSTAINABLE DEVELOPMENT AND PUBLIC PARTICIPATION IN THE DANUBE AND BLACK SEA REGION

Environmental impact of the war: Ottoman-European conflict along the Danube River in the Early Modern Time

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The perception of the environment and of how people love nature, creating thereby its images, has a specific cultural imprint, which varies through history. Quite often, the way one looks upon nature, uses or gets acquainted with it has something to do with traditions, collective suggestions and inheritance connected to culture. In this sense, more than once, the relation towards nature becomes a "mirror" of mentality. In the Early Modern period, the surrounding world was not seen anymore as the sole creation of God with theos and antropos as its pivots, but was step by step replaced by investigation through the realistic eyes of hard science, which helped to use the environment for the purpose of modern civilization.

The correlation between the Danube as an environmental entity and the role this river has played in the Early Modern Habsburg anti-Ottoman policy is a clear-cut example for such a process of mental transition. The present paper is dealing with the discourse *The* Danube as a Habsburg reality of the 17th-18th centuries and its predecessor of the 16th century – the proto-discourse *The* Danube as a part of the European Christian "Raum (Space)". Despite of the plenty of researches devoted to the European-Ottoman relations during Early Modern Period, there are many opportunities for new interpretations and for enlarging the problematic scale of their study. One of these aspects is the impact of "nature" on conflict escalation. There are not only military or strategic conceptual thoughts, but also elements of propaganda and power politics embedded in the environmental impact discourse.

Key words: Danube River, Warfare, Ottoman-Habsburg relations.

A moving island: Nature dynamics and state borders' conflict for nature in modern Southeast Europe

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The Romanian and Bulgarian communities living on the Danube River banks used to graze their animals and take wood from the islands located along the Danube River. Around 1830s, two new islands formed and constituted a rich natural resource for the inhabitants living along the Danube's banks. The 25 ha Eshek Adasi ("The Donkey Island" in Turkish) was closer to the Bulgarian bank, while the 130 ha Ostrovul Bujorescu was located closer to the Wallachian bank. Both islands were located at the km 560 on the Danube, right against the nowadays cities Svishtov and Zimnicea. At that time, Bulgaria was still part of the Ottoman Empire whereas Wallachia was a small Principality under the Ottoman Sovereignty and thus communities along the Danube Valley moved easily across the border. Romania and Bulgaria obtained their independency in 1878 and a process of state modernization started in both countries. This process included the establishment of national borders along the Danube. In this political context, one island became part of the Bulgarian state, whereas the other one became Romanian territory, but border between the two states was still not set in the field (along the Danube). Thus, populations on both shores continued their agricultural practices that were part of their livelihoods since medieval times. Due to the Danube sediments dynamics the two islands merged around 1900. Under the pressures of local authorities, the Romanian government denied access of Bulgarians to the new formed island stirring up their protest. This conflict almost triggered a war due to the absence of an official border in the field. This paper seeks to analyze the international conflict between the two states and the way local population's economic and environmental pre-modern practices intertwined with the emergence of modern institutions of national states. The interplay between local political institutions, national government's politics, the international relations and local practices of access to natural resources is the stake of this paper. We contend that the physical elements (Danube sediments) strongly influenced the emergence of the institutions of the modern state, including a modern bureaucracy and of a modern ideology of statecraft.

Key words: Danube River islands, national borders, agricultural practices, statecraft, Southeast Europe.

Historical change of Danube River fish communities and the interplay with fishery and habitat alteration – a case study for the Austrian river section

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Approaches to define reference conditions without human influence for an assessment according to the EU-WRRL put the historical perspective in the focus of river ecologists and managers. Various studies demonstrated the strong influence of river channelization, flood-protection, hydro-power production or pollution on fish communities as a consequence of industrialization in the 19th century. The latter is certainly a turning point for the ecological conditions of aquatic systems because of the magnitude of human influences. Nevertheless fish communities have been altered also in the centuries before, either directly due to fisheries or indirectly due to habitat change.

This presentation focuses on the Austrian Danube´s fish communities since the 16th century. It discusses methodological limitations which originate from the specifics of available historical sources. Special attention is paid to the turn from the late 19th to the early 20th century when large scale river engineering measures started. The latter went hand in hand with new social and technological circumstances in fishery, fish production and fish supply and new attitudes in protecting fish as a societal resource. Serial data from the Viennese fish market enable tracing the effect of the Danube channelization on fish. The discourse among scientists and fishery experts, as well as fishery and water management laws, illustrate the response of contemporary fishermen to mitigate this adverse process. Attempts to support sufficient fish stocks, e.g. the artificial breeding and introduction of native as well as alien fish species, have nevertheless also to be considered in the light of industrialization.

Putting the Austrian example into the wider context of the entire Danube shows regional historical differences in both fish ecological conditions and fishery development.

Key words: Environmental history, fish communities, habitat change, fishery.

The "glorious" communist past and the "green" ecologic present: Anthropological perspectives over the Danube Delta fishing communities and their natural resource management

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In 1991, the Danube Delta, the largest marshland in Europe, famous for its biodiversity, became a UNESCO Biosphere Reserve. Due to this designation, new regulations concerning local use of the environment have been imposed by the Romanian government and the European Union. Relying on participant observation, in-depth interviews, oral histories and archival work as main research methods, this paper scrutinizes from a cultural anthropologic perspective the changes in the local patterns of natural resource use before (1880s-1950s), during (1960s-1980s) and after communism (1989). The findings show how the resource exploitation of the Danube Delta has been under constant transformation, from capitalist system, to communist one, and back to capitalism combined with "green" policies today.

The second part of the research focuses on the present practices pointing to the locals' perceptions of the environmental discourse. Considering the fact that it seems that personal agenda of the authorities weights more than the rule of law, locals from the Danube Delta see democracy and environmental protection rules as a means for people in key positions to have a monopoly over the highly valued resources of the protected areas, which they profit from in illicit ways.

Consequently, this research argues that due to new environmental policy-making, that systematically ignored the local participation, and due to the weak law enforcement in the context of post-communism, the fishing communities in the Danube Delta experience an acute social and environmental degradation today.

Key words: Environmental protection, fishing communities, Danube Delta.

Environmental impact of wind power plants in Mühlviertel – first results and perspectives

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The European energy policy lays a focus on the substitution of fossil energy sources by renewable alternatives. Wind power plants have found a wide distribution within few decades. It turns out that they have also an increasing socio-economic importance for rural development, because they offer permanent benefit for small municipalities. From environmental point of view potential conflicts exist especially with birds and bats. Another critical topic is seen in the impact on landscape aesthetics.

The conditions and conflicts are very different in various types of landscapes. Coastal areas and main migratory routes of birds are considered as areas of conflicts for the implementation of wind power plants. In inland areas the situation is more complex to assess.

The Mühlviertel is a granite massif in the north of Upper Austria with average altitudes between 500 and 700 m and maximum heights of 1300 m. The northern range is considered to have high potential for de-central wind parks. The municipality of Schenkenfelden has been pioneer in wind energy use since the 1990s. Two wind power plants have been realised in 1998, five more are planned. Technical innovations show a huge difference between height and capacity of old and new wind power plant types. New model reach an altitude of more than 250 m. To assess the potential impact on migrating birds, investigations are carried out over two years. The case study deals with the general environmental planning tools on regional level and first results of project related field investigations: influence on breeding bird populations, analysis of migratory behaviour of birds in inland landscapes without clear topographic pattern and corridors. The investigation design had to be extended from the local impact area to an East-West transect of 160 km between Haslach and Raabs to provide background database on the role of the area for migrating birds, especially predators.

Key words: Renewable energy, environmental impact assessment, wind power plants, birds, seasonal migration.

How the Danube became the environment we know today: On the transformation of a socio-natural site since 1500

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This paper summarizes the great transformation of the Danube as a hybrid, socio-natural site over five centuries from c. 1500 to the present. It identifies two major turning points in the Danube's environmental history - the first around 1750 and another one after World War II. There was some environmental change on the preindustrial Danube already. Early modern warfare was among the most important drivers, although usually overlooked. But from the middle of the 18th century onwards a dramatic change in societies' relationship to the river can be observed. Legions of experts developed projects to 'improve' and 'civilize' the Danube. Many of these, partly utopian, ideas for a Danube of the future were never to be realized, but some of them have been, and they have paved the way for a new type of transformation of the riverine environment during the 19th century that even accelerated significantly after World War II.

This contribution puts the fundamental re-arrangements of the riverine landscapes during the 19th century (such as those in the delta after 1856, in Vienna after 1869, or at the Iron Gates after 1890), and those of the 20th century with hydro power plants along the Upper Danube and at the Iron Gates, with gigantic channel projects for navigation, with land consumption in former floodplains etc, into a long-term, socio-ecological perspective. 'There is no clear line between us and nature' wrote Richard White in his book on the Columbia River. The Danube and its environmental history abound in evidence that this observation is very much to the point. Reconstructing the environmental history of the Danube as the long, common and intertwined history of nature and society might allow us to prepare for a new, sustainable regime of interaction with the dynamic Danube.

Key words: Environmental history; socio-natural sites, long term socio-ecological research (LTSER), politics, technology and environmental change.

Danube Working Community and its role in the EU Strategy for the Danube Region using the example of soil

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The Working Community of Danube Countries was founded in 1990 after the fall of the Iron Curtain as an alliance of regions along the Danube River. Under the permanent chair of Lower Austria common projects are executed in the working committees “traffic and navigation”, “culture and science”, “youth and sports”, “spatial planning and soil protection” (since 2012 combined to “sustainability”).

In different ways these complex topics are implemented in Lower Austria. A Charta for Rural Regions has been developed and an intensive involvement of rural municipalities to regional activities is realised. Like Vienna is the metropolitan center of the region, Lower Austria is the heart of Austrian rural regions. To keep people in small villages it needs at first technical infrastructure and labour conditions. At the same time it needs a perspective for leading a good life and to realise the personal ideas. Continuous de-central activities and projects are necessary to implement sustainable development. This includes the wide range from the protection and maintainance of fruit tree rows along the country roads as well as the implementation of renewable energy sources.

Soil turns out to be strong medium with a high level of identification to raise responsibility for the own environment. Lower Austria is engaged on different levels in the topics of soil protection and soil awareness raising: on the regional level with its soil campaign “Our soil – we stand upon it!” and on the transnational level in the European Land and Soil Alliance ELSA and in the Working Community of Danube Countries. The project SONDAR Soil Strategy Network in the Danube Region carries out cross-border activities with partner municipalities in the Czech Republic, in Slovakia and Hungary. Future activities are concentrated on the EU Danube Strategy and on continuing the cooperation with existing networks with European Commission and with FAO on the occasion of World Soil Year 2015.

Key words: Public relations and awareness raising, implementation by international projects.

POSTERS

TOPIC 1: BIODIVERSITY – FRESHWATER, RIPARIAN AND FLOODPLAIN FLORA AND FAUNA, CONSERVATION, SOIL DIVERSITY AND PROTECTION

River re-naturalisation in the Tisza River basin after forest cutting activities

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Forest cutting is a typical economical activity in the Ukrainian Carpathians. Forest cutting within a river basin and especially wood transportation down the riverbeds leads to almost complete destruction of the river habitats. River re-naturalisation actions done 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 and turbulence. These works were followed by stocking the stream with invertebrates and fish. Hydrobionts for stocking were caught in an undisturbed river, similar to this river by its size, underlying rock and altitude above the sea level.

Mechanical destruction of habitats and excessive amount of timber residues lead to the condition when rivers, influenced by intensive forest exploitation, face replacement of litorheophilic fauna by xylophilic and perophilic one. After it, we observed wide development of xylophilic chippers – *Amphipoda*, followed by eurybiontic predators – *Hirudinea*, gatherers – larvae of *Chironomidae,* etc. But in conditions when the whole riverbed suffers, such "defective" communities can exist for years. In such case, general abundance rates, biodiversity and functional activity of bottom fauna remain rather low while even little efforts for re-naturalisation lead to fast restoration of the river biota.

Key words: Re-naturalisation, macroinvertebrates, forest cutting, small rivers.

The Danube River, essential factor in the distribution of freshwater gastropods within the faunistic provinces of Romania

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The Danube River hydrographic basin within Romania comprises 15 hydrographic basins of the main tributary rivers. The total number of gastropods species identified in the river system reaches 82, belonging to two large systematic groups: 45 Prosobranchiata and 37 Pulmonata. The highest number of species is characteristic to the Danube River, while in the other hydrographic basins, the number is relatively uniform, varying between 54 and 28 species. These species cover a specific space within the biogeographic provinces of Romania. Following the distribution of the gastropods on faunistic provinces, it results that out of the total number of 82 species located within all the rivers, 8 species are characteristic to the Dacian province, 17 to the Moesian province, 2 to the Pannonian province, 21 to the Pontic province, and one species to the Moldavian province. As number of species, there predominate the gastropods from the Pontic and Moesian provinces (45 species), in accordance with the density of the hydrographic network. The endemic species originate in Romania and so far they have been identified only in our country, the decisive role being played by the Danube: *Pseudamnicola (P.) dobrogica*, *P. (P.) leontina*, *P. (P.) penchinati*, *P. (P.) razelmiana*, *P. (P.) bacescui*, *Grossuana codreanui* (endemic species within the Pontic Province), *Oxyloma (O.) pinteri* (Ponto-Danubian endemic species), *Paladilhia (Paladilhiopsis) transsylvanica*, *P. (P.) carpathica*, *Bythinella dacica*, *B. grossui*, *B. molcsany* (endemic species within the Dacian Province). A particular category is represented by immigrant species which come from the neighbouring areas, extending their geographical area and, many times, replacing the local species. The most representative gastropods are: *Theodoxus (Th.) danubialis*, *Th. (Th.) fluviatilis*, *Viviparus acerosus*, *Valvata (Cincinna) piscinalis*, *Esperiana esperi*, *Ancylus fluviatilis*. We may conclude that the distribution centre of gastropods in the aquatic ecosystems in Romania is the Danube, its floodplain, and the Danube Delta, due to the diversity of ecosystem types (streams, lakes, pools, swamps) integrated within this zoogeographical space.

Key words: Gastropods, Danube River, faunistic provinces, Romania.

Using species-area curves technique to estimate the optimum number of samples for benthic macroinvertebrates

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The aim of the study was to establish the number of sampling sites and the number of samples needed for each sampling site in order to reflect the structure of benthic macroinvertebrate communities in Carpathian medium-sized streams, characterized by relative homogeneous habitat conditions.

The case study was carried out on the Lotrioara Stream (the Olt River basin, Romania) – 22 km long, 117 km^2 basin surface, 1278 m average altitude. The results were based on quantitative samples of benthic macroinvertebrates (100 samples) taken in July 2011 from 10 sampling stations 1 km away from each other; on each station, quantitative samples were taken from 10 different points in a transversal profile. The sampling was carried out with an 887 cm^2 surface Surber Sampler, with a 250 µm mesh net. The species-area curves technique was compiled with relative abundance area type charts for each taxonomic group, the linearization of all chart sections indicating the needed number of samples or sampling sites.
The results showed that the 3–5 samples given as standard for benthic macroinvertebrates were insufficient for the reflection of community structure, and 5–9 samples were usually enough for our tested stream category; nevertheless, in some heterogeneous sampling sites, the charts presented significant fluctuations even after the analysis of all the 10 samples taken, proving the need for a larger number of samples. Also, our results showed that the first 9 out of the 10 sampling sites we investigated were sufficient for the reflection of the structure of the benthic macroinvertebrate communities for the studied river.

Key words: Carpathian medium-sized streams, benthic macroinvertebrate communities structure, species-area curves technique, sampling design.

Genetic diversity of reed stands developed in different water bodies of the Danube River

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Effects of water depth on reed development are mostly studied by comparing habitats with different static water depths. Therefore, we have little or no information on how changing water level and water flow velocity affect, for instance, the conditions of germination and seedling development in rivers.

The present paper provides data on the genetic diversity of reed stands grown in (i) artificially controlled running waters with low water level fluctuation; (ii) oxbows with significant water level fluctuations related to the flood events in the main river; and (iii) a separated oxbow which has lost connection to the main Danube channel (*i.e*. it became a lake supported by inland inundation).

At each site, a 300-500 m long sector of reed stands was investigated along transects parallel to the shore and multilocus phenotypes were determined by microsatellite analysis. Based on the resulting genetic data, possible colonization processes of reed stands developing in different riparian habitats can be revealed.

Key words: Microsatellite analysis, riparian habitats, reed colonization.

Comparative analysis of the phytoplankton population in the Lower Danube River in 2009-2011

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This paper is a comparative analysis defining the qualitative and quantitative state and distribution of Lower Danube River phytoplankton on the basis of data obtained between 2009 and 2011 from samples collected along the Romanian stretch. The authors present the phytoplankton specific diversity, numerical density and biomass for each of the following series of samples (according to the sampling year, number of samples, sampling period, number of recorded species and the list of first 10 species ranked by numerical density):

- **2009 - 63 samples - 139 species**: *Cyclotella comta, Cyclotella meneghiniana, Cyclotella stelligera, Navicula gracilis, Nitzschia acicularis, Stephanodiscus hantzschii, Ctenophora pulchella, Koliella longiseta, Diatoma vulgare, Asterionella formosa, etc.;*
- **2010 - 74 samples - 144 species**: *Cyclotella comta, Cyclotella meneghiniana, Asterionella formosa, Ulothrix zonata, Nitzschia acicularis, Ctenophora pulchella, Fragilaria acus, Stelexomonas dichotoma, Koliella longiseta, Melosira granulata, etc.;*
- **2011 - 70 samples - 116 species**: *Asterionella formosa, Cyclotella meneghiniana, Cyclotella comta, Ctenophora pulchella, Ankistrodesmus falcatus, Diatoma vulgare, Koliella longiseta, Navicula cryptocephala, Cyclotella stelligera, Ulnaria ulna, etc.;*
- **Stambulul Vechi - Chilia Branch. 2009 - 24 samples - 69 species**: *Phormidium sp.***,** *Cyclotella comta***,** *Ulothrix variabilis***,** *Microspora stagnorum***,** *Cyclotella meneghiniana***,** *Stephanodiscus astraea***,** *Navicula sp.***,** *Cyclotella ocellata***,** *Oscillatoria tenuis***,** *Ctenophora pulchella, etc.;*
- **Navigable Canal Sulina – Confluence with the Prut River. 2009 - 31 samples - 64 species**: *Cyclotella comta, Cyclotella meneghiniana, Stephanodiscus astraea, Melosira granulata var angustissima, Melosira granulata, Cyclotella planctonica, Monoraphidium contortum, Scenedesmus quadricauda, Cyclotella stelligera, Phormidium sp.*

The paper also analyses the main indicators of the phytoplankton populations and refers to the similarity of the samples through different periods.

According to the ecological significance index calculated for numerical densities, the first 20 or 10 top species of phytoplankton hierarchy represent more than 64% of the population average density. Finally, the authors conclude that the Lower Danube River ecosystem state, at least at the level of primary producers, can be considered satisfactory.

Key words: Phytoplankton species, the Lower Danube River, population abundance, variations.

A pilot study of the Natura 2000 habitat 3260 along the downstream stretches of five Danube tributaries from the Bulgarian sector

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In September 2012, a study of the NATURA'2000 habitat 3260 "Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation" along five right Danube tributaries' mouths was conducted. The species composition of aquatic vascular plants was studied using the routing methodology. Several environmental variables (substrate type, Secchi depth, water temperature, oxygen saturation, electrical conductivity, pH and turbidity) were also measured. The resulting dataset was analyzed and the 5 transects were compared. Thirty vascular plant species and three algal genera were identified. The highest number of taxa was found in the Ogosta and the Lom rivers, including some rare taxa such as *Azolla filiculoides* and *Vallisneria spiralis* in the latter. The environmental conditions and parameters were similar across the study area. However, there were significant differences between some of the hydrophysical parameters, such as the oxygen saturation (200 % in the Lom River; 58 % in the Archar River) and the electrical conductivity (431 µS/cm in the Archar River; 133 µS/cm in the Ogosta River). This study represents an important contribution to environmental monitoring and biodiversity conservation programmes.

Key words: Freshwater aquatic macrophytes, biodiversity, Danube River tributaries, Natura 2000 habitat 3260, environmental monitoring.

Macroinvertebrates of the marine edge and fore-delta of Kyliya branch of the Danube River

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The paper presents results of a long-term investigation on macroinvertebrate species composition that was carried out at the marine edge and fore-delta of Kyliya branch of the Danube River. Uneven distribution of invertebrates in the different areas was established. The mixing zone, where fresh and sea water come in contact, was found to be the most uninhabited zone. It was characterised by hydrological and hydrophysical stress. Only few of the invertebrate species could survive and exist inside the "disaster area" that had originated there.

Growth of the species richness was registered from the open marine areas towards the desalinated water bodies of the marine edge of the delta. Regardless of the increase of species richness that was registered, we found a reduction of Polychaeta, Amphipoda and other Crustacea. In addition, there was an increase of Gastropoda, Oligochaeta and Insecta from the marine areas towards the desalinated water bodies of the marine edge. The changes in the structure of the invertebrate complexes corresponded to the change of salinity: domination of freshwater fauna was typical in the brackish waters, while towards the sea the share of Ponto-Caspian and marine species increased. Moreover, a reduction in the share of filter-feeders and an increase in predators were registered from the sea towards the freshwater bodies.

Key words: Macroinvertebrates, fore-delta, mineralization, species composition.

The influence of the invertebrate drift on the communities of the Danube Delta Marine Edge

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The drift, the interesting and insufficiently known phenomenon in hydrobiology, was studied during the vegetation seasons of 2010–2011 in two arms of Kyliya Branch of the Danube Delta. The paper presents the results of quantitative indices, taxonomic structure and ratio of species with different mode of locomotion and biotopes preferences of the drifting invertebrates. The interconnection between drift and benthic and planktonic assemblages of the fore part of the delta is evaluated. The bearing-out amounts of the invertebrates with the flow of branches to the sea are calculated.

Key words: Drift, invertebrates, Kyliya Delta.

Prewintering aquatic and semiaquatic true bugs in the Timiş River valley (Romania): Adaptation, diversity and the role of human impact

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During a field campaign in November 2011, a small number of active aquatic and semiaquatic bug adults were sampled from several habitats from the Timiş River basin, inside their normal overwintering period. Because of the very small number of individuals, species richness values were very low, and heterogeneity values of the habitats were relatively high. The active state proved to be closely related with higher temperatures of certain deeper, stagnant water habitats, which also have higher amounts of aquatic vegetation and more stable living conditions. The aquatic and semiaquatic bugs sampled were clustering inside aquatic and emergent vegetation, as ethological adaptation to lower temperatures from late fall. Most of the habitats inhabited by aquatic and semiaquatic bugs seem to be of anthropic origin (either excavations in the river meadows, drainage canals or river sectors affected by gravel exploitations), emphasizing the role of moderate anthropic impact in the life of the discussed group and its role in the conservation of certain species. One of the species found in the area, *Aphelocheirus aestivalis*, is Red Listed in some European countries, and was sampled in a single habitat from the 21 investigated, closer to the Serbian border; its absence in most of the river course, heavily affected by gravel exploitations, opens the discussion on investigating the species at a larger scale and its possible inclusion in the Romanian Red List.

Key words: Aquatic bugs, semiaquatic bugs, Timiş River Basin, habitat characteristics, human impact.

Usage of different molecular markers in delimitation of cryptic taxa in *Merodon avidus* species complex (Diptera: Syrphidae)

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Three populations of *Merodon avidus* species complex from two geographical areas in the Danube region (Djerdap and Fruska Gora) were used in this study with the aim to delimitate cryptic taxa within the complex. According to diagnostic morphological characters, as well as to the season of their adult activity, samples were presumably identified as *M. avidus* Rossi or *M. moenium* Wiedemann. In order to reveal genetic differentiation between these taxa and to evaluate their current taxonomic status, two different types of molecular markers were used, allozymes and mtDNA. Analysis of 5 enzyme loci revealed the clear presence of two separated taxa, with presence of unique alleles in AAT (EC number 2.6.1.1) and ME (EC number 1.1.1.40) loci in *M. avidus* and *M. moenium* populations. UPGMA dendogram based on Nei's (1978) genetic distance showed the presence of *M. avidus* and *M. moenium* cluster. On the other hand, the parsimony tree based on cytochrome c oxidase subunit I (COI) mtDNA sequences failed to discriminate these two taxa. Haplotype analysis revealed that one haplotype was shared between *M. avidus* and *M. moenium*. These leaded us to the conclusion that allozyme data with species-specific alleles were more informative for resolving taxonomic questions in *M. avidus* species complex comparing to the mtDNA marker. Moreover, allozymes confirmed different seasonal preferences of two taxa when they exist at the same locality. Since studies of taxonomically diverse and challenging taxa are important for identification of areas of genetic endemism, we highly recommend integrative usage of allozyme and morphological markers.

Key words: Allozyme, cryptic taxa, COI, *Merodon avidus*, Syrphidae.

Diurnal changes in fish assemblages in the Danube River section upstream of Budapest and its tributaries

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Consideration of diurnal changes of fish distribution is one of the basic requirements of standard monitoring of fluvial fish assemblages. Sampling results of day and night electrofishing were evaluated in different types of watercourses, in a very large river, that is the Danube, as well as in tributary of a large stream (the Ipel River) and in tributary of a small stream (the Sződrákos Stream). Samples contained 5244 individuals of 38 fish species in 2012-2013. Species richness and fish abundance in the night samples were significantly higher than in the day samples at low water level in the Danube. Diurnal variability of fish samples in the large stream was less than in the very large river. Difference between the day and the night samples was not significant in the small stream. Preliminary observations indicate impact of running water size on diurnal changes in riparian fish assemblages.

Key words: Standard fish sampling, diurnal dynamics, electric fishing.

Diversity of macrophyte communities in the Danube Delta lakes in 2013

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Macrophyte communities of the Romanian Danube Delta shallow lakes were evaluated in 2013 during the vegetation season (in May, July and late September). The investigated areas (over 20) are located in the four major wetland complexes of the delta: Roşu-Puiu, Gorgova-Uzlina, Matiţa-Merhei and Şontea-Fortuna. The inventories revealed the presence of 25 macrophytes species - 22 vascular and 3 macroalgae. Macrophyte communities varied seasonally due to the hydrological regime and temperature changes. Species richness was higher in July, in smaller and shallower lakes (1-2 m depth, with high organic matter level), where species freely floating on the water surface and rooted species with floating leaves used to dominate (*e.g. Stratiotes alloides* L., *Nuphar lutea* (L.) Sm., *Nymphaea alba* L. and *Trapa natans* L. in L. Erenciuc, L. Cuibul cu Lebede, L. Gorgostel, L. Bogdaproste, L. Merheiul Mic, L. Rădăcinos). Submerged species populated mainly larger, deeper and mineral lakes of the delta (3-4 m depth, nutrient rich; *e.g. Ceratophyllum* and *Potamogeton spp.*, in L. Roşu, L. Puiu, L. Isac, L. Uzlina, L. Trei Iezere, L. Bogdaproste, L. Matiţa, L. Babina, L. Fortuna, L. Tătaru). The hydrological connectivity induced similarity between macrophytes communities in closely located lakes and variation between the ones from different complexes. The importance of the recorded species and their latest determined conservation status, were discussed, as well as the classification of the deltaic lakes typology was reconfirmed within the present research. Further, in 2014, macrophyte assessment will be continued in field and data analysis will be extended.

Key words: The Danube Delta lakes, macrophytes, diversity.

Macrofungi on driftwood in the Danube River arms of the „Donau-Auen“ National Park, Austria

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Dead wood in aquatic ecosystems, such as rivers and streams, is an important component of ecosystem processes. By affecting the river morphology and by providing a major source of organic carbon, driftwood creates a specific and complex habitat for a variety of different organisms, including fungi. In the National Park (NP) "Donau-Auen”, Austria, revitalization of riverbanks and reconnection of backwaters with the main flow enabled accumulation of driftwood in the river arms. The aim of this study was to examine the diversity of fungi on these driftwood accumulations in order to evaluate the importance of these microhabitats in the floodplain forest ecosystems and potentially contribute to their conservation.

This work reports the results of a survey conducted in autumn 2009, at four different sites along river branches (in NP "Donau-Auen”). These sites were selected according to the presence of large amounts of accumulated dead wood material (more than 15 logs). For sampling of macrofungal fruiting bodies we chose and marked logs with at least some bark remaining, in order to determine the tree species to investigate potential substrate preferences of fungal species. From a total of 185 examined macrofungal sporocarps within four investigated sites, 55 species were identified, belonging to 43 genera. Ten species were new for the existing list of fungi in the National Park. The most abundant and widespread species was *Mycena hiemalis*. The greatest diversity of lignicolous fungi was found on site 4 (29 taxa) and site 1 (27 taxa), which were characterized by the highest quantity of woody debris. *Salix alba*, a tree species characteristic of early succession states of the riparian forest, was the substrate with the highest number of identified taxa of macrofungi (21 taxa).

It can be concluded that investigated accumulations of driftwood represent unique and important habitat for lignicolous fungi which are primary decomposers of wood and drivers of the recycling of matter in nature.

Key words: Driftwood, lignicolous, macrofungi, river arms.

Occurrence of the benthic water bug *Aphelocheirus aestivalis* (Heteroptera: Aphelocheiridae) in the Lower Danube River (Bulgaria) and its tributaries

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The benthic water bug, *Aphelocheirus aestivalis* (Fabricius, 1794), has the rare ability among water bugs to use the oxygen dissolved in water for breathing. The species distribution is restricted to waters with high oxygen content and low nutrient concentrations. Human activities, such as water pollution and stream regulation can cause extinction of the species subpopulations in the affected sites. For this reason, *A. aestivalis* have been included in the IUCN categorization lists of some European countries. Regular monitoring of the species occurrence has not been carried out in the Bulgarian part of the Lower Danube River and its tributaries. Therefore, accurate information about the species biology and distribution in this region is required. In the present study, the relationships between *A. aestivalis* occurrence and the abiotic environmental variables have been statistically analysed. The samples and abiotic environmental data sets used in this study have been obtained during implementation of different projects. Forty eight samples with presence of *A. aestivalis*, containing adults and nymphs of different stages (instars) from 43 localities were sorted. The specimens' number of every instar was determined in all the samples. The relationship between *A. aestivalis* occurrence and the abiotic environmental variables has been analysed separately for the different instars of the species. Significant variances of the relationships' strength among the different developmental stages (nymphs and adults) could influence the results of further analyses of *A. aestivalis* environmental preferences. Then these differences have to be taken in account when models of distribution are made and if data on the species is analysed in environmental studies.

Key words: Water bugs, Aphelocheiridae, The Lower Danube River

Spatial distribution of phytophilous macroinvertebrates in a side arm of the Middle Danube River

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The spatio-temporally diverse and variable hydro-ecological conditions of rivers and their floodplains determine the living conditions and hereby the dynamic changes of the organism assemblages. The Gemenc and Béda-Karapancsa Danube River floodplains (1497-1433 rkm) are a part of the Duna-Dráva National Park (Hungary), and they represent an exceptional example of river-floodplain systems in Europe with meanders, oxbow lakes, marshlands and extended hardwood forests (25,000 ha). These floodplains are also a Natura 2000 area and UNESCO Biosphere Reserve Park. After the river regulations in the 19th century, this area has changed.

The Mocskos-Danube side arm (MDU: 3.5 km length, 60 m wide), situated in the active floodplain, became an oxbow lake after the river regulations (1890). It has a surface lateral connection with the main channel above the medium water level of the Danube River (550 cm at the gauge Mohács, rkm 1447). The water level fluctuation of the Danube River is 9 meters. Another one is the Riha Oxbow (4.5 km length, 80m wide, paleopotamon, on the protected side). It has no connection with the main channel.

There are two very dense macrophyte stands *(Trapa natans* and *Ceratophyllum demersum*, respectively) along the MDU and the Riha. The extension of these different-size macrophyte patches and the associated phytophilous macroinvertebrates (especially mayflies, caddisflies, dragonflies) were examined. The sampling work was carried out monthly between May and October 2012. The investigations focused on differences in the phytophilous macroinvertebrate assemblages living in different bed of macrophyte species, with different morphology, on the ecoton effects, the occurance of the phytophilous macroinvertebrates in the centre and the edge of macrophyte patches. Certain phytophilous macroinvertebrate assemblages preferred different macrophyte densities. At the same time, there were differences in the individual number of macroinvertebrates between the centre and edge of macrophyte patches.

Key words: Large river, floodplain, macrophyte assemblages, phytophilous macroinvertebrates.

Does wild boar act as a pest species in Gornje Podunavlje Protected area – conclusions from genetic data?

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The wild boar represents one of the most abundant wildlife species in Europe. In the last four decades remarkable expansion of wild boar populations was observed and development of adequate management strategies is urgently needed. The main aim of this study was genetic analysis of wild boars in „Gornje Podunavlje“ Special Nature Reserve in order to provide evidence if demographic expansion of wild boars have impact on overall biodiversity in this area. Muscle tissue samples of 20 wild boars were collected and multiplex PCR amplification of 11 tetra nucleotide microsatellites was carried out. Hypervariable domain of the mtDNA control region was amplified and sequenced as additional marker. Levels of genetic diversity were assessed using standard population-genetic softwares. The analysis of microsatellite loci revealed total number of 88 different alleles, with a mean number of 8 alleles per locus. Average observed heterozygosity was 0.71, which is higher comparing to other European wild boar populations. Average expected heterozygosity value was also high, 0.75. Analysis of CR mtDNA sequences showed presence of 3 different haplotypes in analyzed region. Haplotype diversity value was Hd=0.633, while nucleotide diversity was π=0.0023 and average number of nucleotide differences k=1.0333. The levels of genetic diversity observed in analysis of mtDNA sequences in „Gornje Podunavlje“ Special Nature Reserve were similar to values obtained in analysis of wild boars from the extended region of western and central Balkans. The mismatch distribution didn’t show a statistically significant deviation from expectations, indicating demographic expansion of analyzed population. Both applied molecular markers, microsatellites and mtDNA, revealed high level of genetic diversity in wild boars from „Gornje Podunavlje“ protected area, which may indicate that analyzed species has high genetic potential for further expansion accross the region and impact on biodiversity.

Key words: Genetic diversity, *Sus scrofa*, mtDNA variability, microsatellites.

Analysis of structure, composition, spatial and temporal changes of juvenile fish community in a Danube-tributary system in the Middle Danube River Basin

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Tributary inputs can be important community reorganisation sources for large river biota as demonstrated by *e.g.* the cyanide spill of the Tisza River. Analysing the distribution and abundance of fish species and ecological guilds in regulated rivers allows us to determine the conservation targets for the fish community of river-tributary complexes. However, only few studies have examined the long-term effects of tributary inputs on large river fish populations so far. At the lower section and the mouth of the Ipoly River, the juvenile fish assemblage was surveyed between 2011-2013 by electrofishing once in each season along five sections at the lower section of the Ipoly River from Ipolytölgyes to the mouth, and five sections along both banks of the Danube River downstream the mouth of the Ipoly River. Altogether 37 fish species were recorded, 10 of them were non-native. Bleak and other juvenile *Cyprinidae* species (*e.g. Abramis* sp.*, Aspius aspius, Barbus, barbus, Carassius gibelio, Chondrostoma nasus, Cyprinus carpio, Leuciscus idus, Squalius cephalus, Vimba vimba*), which are present in large populations in the Hungarian section of the Danube River, were the most abundant and frequent in the lower sections of the Ipoly River, contributing to 61% of the total catch. At the mouth section of the Ipoly River, the invasive *Neogobius* sp. were the most abundant fishes (47%). Large woody debris and flooded terrestrial vegetation was identified as the most important habitat structures of riverine cyprinids, while gobiids (*e.g. Neogobius* sp., *Ponticola kessleri*) preferred ripraps. The results demonstrate that river rehabilitation and mitigation measures should provide natural floodplain and river bank conditions as the most important natural in-channel structures to improve the lateral connectivity of large rivers for the benefit of fishes.

Key words: Tributary, juvenile fish assemblage, ecotone, Danube River, Ipoly River.

Diet composition of the dice snake (*Natrix tessellata* Laurenti, 1768) (Reptilia: Colubridae) in the Danube River Catchment Area

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Natrix tessellata (Laurenti, 1768) is a diurnal piscivorous Eurasian snake species with a large distribution area. The Danube River is a main aquatic corridor and its floodplain is an important habitat for this species, which lives in all the countries along the river due to its good adaptability to different climate, altitude and even human activities enabling it to live in human-dominated landscape as well. In spite, however, decline and genetic bottlenecks have already been recorded in several countries in the western part of its distribution area, while new populations are still described, especially in the east. The aim of this paper is to give an overview on the feeding spectra of *N. tessellata* in countries along the Danube River and their comparison related to different stretches of the river.

The detailed analysis of the diet of *N. tessellata* is based on species level data from 8 countries from the Danube River Basin (Austria, Bulgaria, Croatia, Czech Republic, Hungary, Romania, Serbia, Slovenia). On the basis of own data and the special literature, *N. tessellata* feeds on benthic (*Neogobius* sp, *Ponticola* sp.) and open water (*Cyprinidae* sp., *Gymnocephalus schraetser*, *Perca fluviatilis*) fish species in the main arm of the Danube River and its tributaries. In streams flowing into the Danube River, side arms, temporal ponds in the floodplains, densely vegetated water courses and fish ponds, it feeds on fish (mainly *Cyprinidae* sp.), amphibian larvae and semi-aquatic adults (mainly *Pelophylax* species) staying in or near the water. Other prey items are also taken occasionally, which indicates the good adaptability of the species to different conditions. The feeding spectrum characteristically changes in the countries along the Danube River with differences in the feeding spectra in the Lower Danubian (Bulgaria, Romania), Middle Danubian (Hungary) and Upper Danubian (Austria) countries.

Key words: *Natrix tessellata*, Reptilia, feeding spectrum.

TOPIC 3: ECOSYSTEM SERVICES, WETLANDS, SUSTAINABLE USE OF BIOLOGICAL RESOURCES

The diversity of forest communities in the Kovilj Marsh (Serbia)

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The Kovilj Marsh is a part of the Danube River floodplain in Northern Serbia. It is a rare piece of nature which still preserves the original characteristics of wetland biotopes. Potential natural vegetation of Kovilj wetland is forests of willows and poplars, due to the hydrological regime of the area. The biggest part of this area is habitats altered by anthropogenic activities (forest plantations and degraded woodland – 55.6%).

The aim of this work is to analyze the diversity of forest flora and vegetation in the riparian zone of the Danube River in Kovilj Marsh.

The analysis of forest vegetation was based on data from 113 relevés, from the literature and taken in field research during 2013. The phytocoenological relevés included natural and artificial vegetation, and degraded forests in the floodplain. Different forest communities were compared using Sørensen and Ellenberg indices of similarity, and index of their beta diversity.

Detrended correspondence analysis (DCA) of Ellenberg's ecological indices showed great similarity of white willow natural communities and planted willow communities. Same analysis showed a clear distinction between natural and artificial phytocoenoses of poplar. Results of DCA revealed significant differences in the floristic composition of the Euro-American poplar forests depending on whether they were planted in occasionally or permanently flooded habitats. The environmental conditions of habitats in which communities of Euro-American poplar and white poplar occurred were similar according to light and the amount of moisture in the soil.

Due to natural value of the area, which was declared as a protected nature reserve by the Decree of the Government of the Republic of Serbia in 1998, vegetation surveys of this part of the Danube River floodplain should continue in the future.

Key words: Kovilj Marsh, Danube River riparian vegetation, DCA, beta diversity.

Bacterioplankton of wetlands along the Lower Danube River (Bulgaria) and its relation to environmental factors

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Several temporary and permanent wetlands of lake type (Peschin, Murtvo Blato and Dulyova Bara), canal type (Brushlen, Kalimok) and a Danube River branch (Belene Island) were sampled seasonally during the vegetation period from summer 2009 until spring 2012. The bacterioplankton as the most abundant component of plankton communities and participating in biogeochemical processes was determined by its abundance, biomass, morphological and size structure. The environmental variables measured simultaneously encompassed temperature, pH and dissolved oxygen, as well as nutrients (N, P and Si) and chlorophyll-a. Spatial and temporal variability of bacterioplankton and its relations to environmental variables were tested by statistical analyses. Bacterioplankton numbers were higher in the marshes than in the canals and the highest in the river, with spring maximum, increasing towards 2011 during the lower water level of the Danube River and decreasing in 2012 during the new flooding after the total dry up. In 2011 phototrophic anaerobic purple sulfur bacteria from the genera *Chromatium* and *Thiopedia* in the canals and filamentous phototrophic green nonsulfur bacteria from the genus *Chloroflexus* both in marshes and in a canal were encountered. Turbidity, chemical oxygen demand, total nitrogen and the depth were positively, ammonium ions and the distance of the wetlands from the Danube River, negatively related to the dynamics of bacterial morphotypes and sizes.

Key words: Bacterioplankton, abundance, wetlands, nutrients, chlorophyll-a, relations.

Analysis of ecosystem services of wetlands along the Bulgarian Section of the Danube River

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The study covers five wetlands situated on the Bulgarian Danube floodplain and four – on the Danube River islands. The significance of twelve different ecosystem services was assessed and plotted on 6 point scale using both reference data and interviews of local stakeholders. For the wetlands on the floodplain, a comparison was made between the period before the 1940s (at predominantly natural flooding regime) and the current state (under dramatically changed flooding regime). The potential ecosystem services after eventual rehabilitation/ conservation of the focused wetlands were also assessed.

The use of natural resources (*e.g*. fish, reed beds, flooded meadows, floodplain forests), nutrient reducing, carbon retention, flood protection, agriculture and cattle breading, were identified as main types of ecosystem services provided by the wetlands on the Bulgarian Danube River floodplain before the 1940s. Currently, the ecosystem services provided by these wetlands are limited mainly to the education/research and recreation (hunting, angling) activities.

The main ecosystem benefits provided currently by wetlands on the Danube River islands are the natural fish resources used by local communities albeit in a much lesser extent than in the past.

After eventual rehabilitation/ conservation and appropriate management of wetlands, an increase of ecosystem potential for development of tourism and other recreational activities, strengthening education/ research activities, nutrient trapping and carbon retention could be expected. However, a further significant increase in the exploitation of natural resources seems hardly possible.

Key words: Wetlands, Danube River, flooding regime, ecosystem benefits, research activities, natural resources.

TOPIC 4: CLIMATE CHANGE, HABITAT CHANGE, HYDROMORPHOLOGY

Microcrustacean (Cladocera, Copepoda, Ostracoda) diversity in three side arms in the Gemenc Floodplain (Danube River, Hungary) in different hydrological situations

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The Gemenc floodplain is situated on the right bank of the Danube River, between the rkm 1498 and 1469. It is 30 km long and 5-10 km wide, covers 18000 hectares and is unique as a floodplain in Central Europe. In order to compare the different microcrustacean assemblages, our sampling covered a wide range of water bodies, with different properties: the main arm of the Danube, two parapotamal type side-arms: the Rezéti-Holt-Duna (15 km long) and the Vén-Duna (5 km long) and the plesiopotamal Grébeci-Holt-Duna (7 km long).

64 microcrustacean species (39 Cladocera, 18 Copepoda, 7 Ostracoda) were recorded between 2002 and 2009, and the assemblages of the main-arm and the side-arms differed in terms of density and species composition. The densities were usually low in the faster flowing water bodies (in the main arm and the Vén-Duna) and high in the periodically stagnant Grébeci-Holt-Duna. There was a negative correlation between the water level of the main arm and the density and taxa number of the assemblages in the side-arms. In case of physical parameters, positive interaction was observed between the water temperature and the density of microcrustacean assemblages. The observed fluctuations of hydrological-hydrobiological interactions highlight the significant spatio-temporal variety of the floodplain, which is primarily influenced by the water level of the Danube River.

Key words: Cladocera, Copepoda, Ostracoda, Danube River, Gemenc Floodplain.

Short term isotopic signals in the Danube River water at Tulln (river km 1963) in 2012

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Isotope ratios in the Danube River water clearly reflect the isotopic composition of precipitation water in the catchment area since evaporation influences on the isotope ratios play only a minor role. Results of stable isotope measurements (δ^2H, $\delta^{18}O$) of daily grab samples, taken from the Danube River at Tulln (river km 1963) during 2012 show seasonal and short term variations depending on the climatic/hydrological conditions and changes in the catchment area (temperature changes, heavy rains, snowmelt processes). The isotope hydrological behaviour of the Danube River in 2012 does not deviate significantly from long-term averages except in January, when heavy rainfalls (warm period) caused high flow rates with elevated δ^2H and $\delta^{18}O$ values. Average δ^2H and $\delta^{18}O$ values in 2012 were -78 ‰ and -11.0 ‰, respectively, deuterium-excess averaged 10 ‰. Snow melt processes caused minima in the δ^2H and $\delta^{18}O$ course (summer minima are typical for alpine rivers), summer rains were responsible for maxima, and during base flow conditions the isotopic composition returned to the mean value in the system. The entire variation amounted to 1.8 ‰ in $\delta^{18}O$ and to 15 ‰ in δ^2H. Quick changes of the isotopic composition within a few days emphasize the necessity of daily sampling for the investigation of hydrological events, while monthly grab sampling seems sufficient for the investigation of long-term hydro-climatic trends. ^3H results show peaks (half-width 1-2 days, up to about 150 TU) exceeding the regional environmental level of about 9 TU, probably due to releases from nuclear power plants. Such ^3H peaks can be used to study travel time and dispersion (mixing) of contamination pulses in the Danube River. This could be a basis for the development of emergency measures to deal with pollution in the catchment area.

Key words: Isotope hydrology, river water, Danube River, deuterium (^2H), tritium (^3H), oxygen-18 (^{18}O).

Effects of salinity on the zooplankton communities in the fore-delta of Kyliya Branch of the Danube River

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The investigation covered the fore-delta shallow water habitats of the Kyliya Danube River branch: bays on the marine edge and mouths arms. The contact zone of salt and freshwaters was characterized by variety of hydrophysical and hydrochemical parameters that caused the dynamics of structural indices of zooplankton. The paper presents the results of zooplankton studies (Cladocera, Copepoda, Rotatoria, Ostracoda, Foraminifera and veligers not identified to species) focusing on waters of different salinity (from 0.28‰ to 12.00‰). The domination of freshwater complex was established. The species richness of zooplankton was reduced with increase in salinity, the freshwater species disappeared and the frequency of occurrence of euryhaline species decreased. Significant reduction in zooplankton species was observed at mineralization about 2.00‰.

Key words: Zooplankton, fore-delta, mineralization.

TOPIC 5: INVASIVE ALIEN SPECIES – EARLY WARNING, PRIORITY SPECIES AND PATHWAYS, RISK ASSESSMENT AND MANAGEMENT

Neozoa of the Kyliya Branch of the Danube Delta

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The Danube Delta is a gate of penetration of alien species to Europe. In recent years, the expansion of alien species has continued, being enhanced by the climate changes, intensification of economic activities, development of water transport, etc. The aim of this study is to make a review of the alien species of benthic macroinvertebrates, which have been registered so far in the Ukrainian part of the lower reaches of the Danube River.

Key words: Invasive invertebrates, Kyliya Delta.

Invasive crayfish on land: *Orconectes limosus* (Rafinesque, 1817) (Decapoda: Cambaridae) crossed a terrestrial barrier to move from a side arm into the Danube River at Szeremle, Hungary

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Non-indigenous crayfish species have successfully invaded European lentic and lotic ecosystems in the past 120 years. *Orconectes limosus* (Rafinesque, 1817) has one of the largest distribution areas from among those taxa. Its invasion front has recently reached the Lower Danube River, while it also gradually colonises the Middle Danube tributaries and adjacent areas in the Carpathian Basin. Several biological characteristics help the spread of *O. Limosus*, such as the potential shift of its mating regime towards facultative parthenogenesis and the high tolerance towards the crayfish plague, a fungal disease caused by *Aphanomyces astaci*, lethal for European crayfish. The first enables multiplication under low abundance while the latter is a key factor when coming into contact with indigenous crayfish in Europe. As *O. limosus* is often a carrier of the crayfish plague, it infects native populations, which are usually wiped out fast by the disease creating crayfish-free habitats for the invasive species. Furthermore, the fecundity of *O. limosus* is also higher than that of European crayfish, *e.g. Astacus astacus*.

A further characteristic with invasion implications was observed along the River Danube at Szeremle, Hungary. On 28th September, 2011, at 3.15 pm., an adult *O. limosus* individual was observed walking from the Szeremle side arm towards the Danube River; these are separated by a dike under low or medium water level. The individual successfully crossed the dike and covered a distance of approximately 20 metres between the two separated waters. It is the first record of O. *limosus* in the Danube River catchment crossing on land from one water into another. This behaviour definitely helps the colonisation of new water bodies *O. limosus* if only small stretches of land separate inhabited and non-inhabited waters.

Key words: *Orconectes limosus*, Decapoda, spreading, invasion.

Alien bivalve mollusk occurrence, population dynamics and impact: Lake Maggiore (Italy) and the Danube River (Bulgaria) case studies

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Nowadays, the presence of alien species is a worldwide problem, especially when the presence of the new species has the character of a biological invasion which threatens biological diversity and affects ecosystem services thus causing environmental, economic and social damages. The freshwater bivalve *Dreissena polymorpha* is included among the 100 World's Worst Invasive Alien Species (IUCN/SSC ISSG), and *Corbicula fluminea* and *D. polymorpha* are listed among the 100 Worst Invasive Alien Species in Europe (DAISIE). Further, the Chinese Pond Mussel *Anodonta woodiana* and the Quagga Mussel *Dreissena rostriformis bugensis* are becoming globally spread in last decades, causing biodiversity and economic losses. Here, we show how different environments, such as a big subalpine lake, Lake Maggiore (Northern Italy) and the second longest river in Europe, the Danube River (Bulgaria), are affected by similar problems: the invasion by non-native freshwater bivalves; and how these different habitats influence the occurrence and population dynamics of the invaders.

Presence-absence maps have been prepared to present the distribution of the bivalve alien species (*C. fluminea*, *D. polymorpha*, *A. woodiana* and *D. rostriformis bugensis*) in the two different freshwater bodies, Lake Maggiore and the Danube River (Bulgaria). In addition, to evaluate the potential impact of *C. fluminea*, which is rapidly becoming the dominant littoral species in Lake Maggiore, a field and mesocosm study of its population dynamics and reproductive cycle is presented. The results from the study of quantitative parameters and habitat characteristics of *C. fluminea* and other alien bivalves in the Bulgarian sector of the Danube River and its tributaries are also presented.

Key words: Alien species, freshwater bivalves, *Corbicula fluminea*, *Dreissena* spp., the Danube River basin, Lake Maggiore.

Acknowledgements: This study was supported within the frames of the East and South European Network for Invasive Alien Species (ESENIAS) and the International Association for Danube Research (IAD), and partly funded by the Rotary Club project "One Lake, three Districts, only one Rotary" 2012-2013.

High genetic potential of invasive *Ambrosia artemisiifolia* L. populations in the Middle Danube River Basin

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Ambrosia artemisiifolia L. (common ragweed) is a widespread, invasive plant species commonly found in many disturbed, ruderal terrestrial sites. Dispersal of common ragweed occurs mostly by human activities through soil and seed transport. In addition, considering the ability of seeds to float, hydrochory appears to be an important dispersal mechanism along rivers. Data on genetic variability and genetic differentiation between populations may help to predict the potential further expansion of the alien species, which may offer opportunities for development of effective prevention and management strategies. In the order to conduct genetic assessment of potential of common ragweed populations in the considered area, we have used five microsatellite markers (*Amb12*, *Amb16*, *Amb30*, *Amb82* and *Ambart04*). A total of 104 individuals of *Ambrosia artemisiifolia* collected on the territory of the middle region of the Danube River Basin (Sombor, Lug, Ostrovo, Ilaca, Smederevo) were genotyped. Regarding the basic measures of genetic diversity, we have detected high level of genetic variability in populations. AMOVA results and Fst values revealed that variation attributed to among-population differentiation was low, while the major portion of the molecular genetic variation was found within populations. Observed data indicated that *Ambrosia artemisiifolia* in analysed area has genetic potential to be aggressive and abundant, presenting a significant challenge in preventing further spreading of the species in considered area.

Key words: Genetic diversity, *Ambrosia artemisiifolia*, Danube River Basin, invasive species.

Cabomba caroliniana A. Gray in the Canal Network in Serbia – influence on the plant species diversity and structure of aquatic vegetation

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The scope of this work was to analyze the influence of invasive plant species on indigenous vegetation. It was done by comparing the features of aquatic vegetation on selected sites, before and after the appearance of *Cabomba caroliniana* A. Gray in the canal network in northern Serbia. *C. caroliniana* is native to South America. It has been introduced in North America and Australia, as well as into several Asian and European countries. In Serbia, it was recorded in 2008, in the north-western part of the canal network. Until 2012, it spread into the rest of the network in Bačka (territory between the Danube River and the Tisa River), while it has not been found in the Banat region. According to its population dynamics, *C. caroliniana* appeared to be invasive. Comparing the vegetation traits recorded in earlier investigations with ones found after the *C. caroliniana* invaded the canal network, significant differences were found in floristic composition, species richness, Shannon's Diversity Index and Evenness, as well as in ecological indicator values and plant's functional types, and many of them could be directly or indirectly explained by the invasive dynamics of *C. caroliniana* populations.

Key words: Invasive alien species, canals, aquatic macrophytes.

TOPIC 6: WATER QUALITY ELEMENTS, ECOLOGICAL STATUS, EMERGING POLLUTANTS, MICROBIOLOGY, ECOTOXICOLOGY, BIOMONITORING AND SAPROBIC SYSTEMS

Decomposition of willow leaf litter in an oxbow lake of the Danube River at Gemenc, Hungary

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The decomposition dynamics of willow leaf-litter was studied in Nyéki Danube Oxbow Lake by litter bag technique.

The dry mass, ash free dry mass (AFDM), litter chemistry as nutrients (C, N, P, S) remaining, and microbiological parameters: the litter associated fungal biomass by ergosterol concentration and the potential microbial respiration by electron transport system (ETS) activity, were determined. At the beginning of decomposition, 19% of AFDM were leached out. The loss of mass followed a simple negative exponential pattern during the 140 day of decomposition period. By the end of the decomposition, 31% of AFDM remained.

The factors, which influenced the litter associated microbial mineralization processes, were the temperature, pH of the water and the quality of leaf litter.

Key words: Decomposition, leaf litter, willow, floodplain, oxbow.

Phytoplankton biomass and community structure along the River Danube

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During Joint Danube Survey 3, we analyzed the phytoplankton biomass and community structure along the Danube River from Regensburg to the Black Sea. Within the 6 weeks of the survey from 13 August to 26 September we collected more than 100 samples at 56 sampling sites. Our investigation included measurement of secchi depth, analysis of qualitative net samples, and determination of chlorophyll-a content, as well as pigment composition. Those measurements were conducted at each sampling site at 3 points (left, middle and right) along the cross section of the Danube River. Our findings display the development of phytoplankton biomass in the course of the Danube River and differences within the cross sections. Based on the qualitative analysis of the net plankton and HPLC analysis of pigment composition we are able to show variation of species diversity and changes in algal class composition along the Danube River.

Key words: Danube River, phytoplankton, chlorophyll-a, HPLC, biomass, pigments.

Ecological status of shallow lakes in the Bulgarian Danube River floodplain according to the ECOFRAME approach: Testing a system for integrated ecological quality assessment

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According to the Bulgarian legislation, the ecological assessment of lakes and dams is based mainly on physical and hydrochemical parameters, and only two biological quality elements *i.e.* phytoplankton and macrophytes are used. The macrozoobenthos, fish and zooplankton communities are not standardized yet as biological quality elements for standing waters. In this study, four shallow lakes in the Bulgarian Danube River floodplains were surveyed for evaluation of their ecological status. The integrated method designed for ecological assessment of shallow lakes called ECOFRAME approach was tested. The system was developed for the implementation of the Water Frame Directive and includes the usage of all biological quality elements.

The investigation was made in the summer of 2012. The samples were taken and estimated as described in the ECOFRAME methodology, or by state of the art methods.

According to the analyzed biotic variables, only the Srebarna Lake was assessed in Moderate ecological status, while the other three were assessed in Poor status. The abiotic variables determined a Poor ecological status of all the lakes studied and it was accepted for the final assessment. The results obtained suggest that the ECOFRAME method for ecological assessment needs further verification for the specific conditions in the shallow oxbow lakes characterized by quite different dynamics of the flooding regime.

Key words: Oxbow lakes, ecological status, the Lower Danube River floodplain.

Assessment of water quality in the Ukrainian Part of the Danube Delta based on biotesting and bioindication of bottom sediments

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The Danube Delta receives different pollutants from almost all length of the river. Therefore, assessments of the ecological state of this region are in high priority. This study represents results of monitoring during the period 2007–2012 in the Ukrainian Delta region using biotesting and bioindication methods.

The sampling stations were: Kilia arm (1 station), Ochakivskyi arm (2 stations), Bystryi arm (2 stations) and Vostochnyi arm (2 stations). An animal test-organism *Daphnia magna* Strauss together with plant test-organisms *Allium cepa* L. and *Lactuca sativa* L. were used in the biotesting. The bioindication was performed using taxonomic diversity of the macrozoobenthos organisms. The following biotic indices were calculated: Trent Biotic Index, Belgian Biotic Index, Biological Monitoring Working Party Index, and Goodnight-Whitley Index.

The findings of biotesting showed slow decrease in the toxic impact level from 2007 to 2012. However, most of the biotic indices calculations showed “high” pollution level for all sampling stations through all the years of monitoring.

Key words: Biomonitoring, ecotoxicology, Delta region, bioindication.

Assessment of the ecological status of the Ogosta River, Northwestern Bulgaria, based on macrozoobenthos and general physical and chemical quality elements

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The Ogosta River is one of the biggest rivers in North-Western Bulgaria, a tributary to the Danube River. The study presents the results from research on the macrozoobenthos in the Ogosta River as a major biological quality element and on selected physical and chemical parameters of the river water. The results are used to assess the ecological state of the river. The research was conducted at seven sites along the river in August and October 2010 and in May and August 2011. The ecological status was determined by the one-out-all-out principle. During the study, 56 taxa belonging to 15 benthic groups were found. In the upper parts of the river, the state varied from very good to good. Downstream, the influence of the city of Montana and many small farms in the river basin led to the deterioration of the river state to moderate.

Key words: The Danube River tributaries, ecological state, macrozoobenthos, the Ogosta River, Water Framework Directive.

The SERCON (System for Evaluating Rivers for Conservation) assessment of the Tamiš River

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As much as other rivers in the region, the Tamiš River has been a challenge for biological surveys for decades. Nevertheless, these surveys are usually focused on specific groups of organisms. The Tamiš River, one of the Danube's main tributaries, rises in the Semenic Mountains, Romania. It flows through Romania and Serbia to the Danube.

The aim of this study was to assess the ecological status of the Tamiš River using SERCON (System for Evaluating Rivers for Conservation) method for defining river conservation value, in which river features and the impacts on river systems are assigned scores. Information on each attribute is used to create a picture of the river in terms of traditional conservation criteria such as Naturalness, Species Richness, and Rarity. The SERCON evaluation demands a vast amount of data, which is obtained from different sources of information. The prime motivation for developing a new technique for river conservation assessment is a perceived need to increase the breadth, rigour and repeatability of evaluations, and shifting the focus from merely seeking ways of protecting to the best to managing, improving and restoring river resources across the full spectrum of conservation value. Moreover, with the demands of the Water Framework Directive, the need for new river monitoring programmes relevant tools for evaluating river 'quality' are very much in demand. Field surveys were carried out during 2009-2010 at six representative sampling sites: 1. Jaša Tomić, 2. Sečanj, 3. Botoš-Tomaševac, 4. Farkaždin, 5. Opovo, and 6. Pančevo. Observations of the features and artificial modifications were made along a standard 500m length, with six RHS (River Habitat Survey) spot-checks, sampling of macrozoobenthos and fish fauna at six representative sampling sites, and macrophytes at nine LEAFPACS spot-checks.

The values of the final SERCON scores were 54 % for the first section (ECS1) and 56 % for the second section (ECS2). Therefore, these two sections have a mean ecological status. Based on 66 % of the analyzed features, which comprises B criterion of relevance, it is concluded that the assessed SERCON value of the two observed sections of the Serbian part of the Tamiš River maintain the medium status.

Key words: SERCON, software, the Tamiš River, catchment, conservation, ecological status.

TOPIC 9: SUSTAINABLE DEVELOPMENT AND PUBLIC PARTICIPATION IN THE DANUBE AND BLACK SEA REGION

Relations between local communities and sustainable management policies in the Danube Delta

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The Danube Delta Biosphere Reserve was established by the Romanian government in 1990, covering 5.800 square kilometres of wetland. Due to its international importance, the Danube Delta was listed in 1990 among the world network of biosphere reserves under the Man and Biosphere Programme. The main objective of the biosphere reserve is to promote and demonstrate the harmonious relations that should exist between people and the environment, and especially to promote a model for harmonizing the requirements of environmental protection with sustainable economic and social development of local communities. Within the Danube Delta, the population is concentrated in 26 villages and 1 town, registering a decrease in number of inhabitants in the last 40 years of analysis, with high variations for the different periods of management: the communism period and the post communism period. This paper is aimed to reveal the relations between the Danube Delta's management policies and the local community's evolution trend, and how these relations had determined an increasing tendency of depopulation, migration, high rate of aging, and negative population growth in the Danube Delta. The work covered a period of more than 40 years, based on the data from Census of Population and Housing, Statistical Yearbooks provided by the Tulcea County Department of Statistics. Sustainable development of the Danube Delta's local communities is a challenge and a priority at the same time. The local community has to be receptive to external and internal management changes that can influence it, and has to adapt to these changes through local strategic actions and initiatives.

Key words: The Danube Delta, sustainable management policies, local community.

Danube: Future - A sustainable future for the Danube River Basin as a challenge for the interdisciplinary humanities

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Danube: Future project is a unique combination of regional, national and supra-national initiatives in interdisciplinary sustainability research with training and capacity building. It contributes to the sustainable development of the Danube River Basin (DRB) with particular focus on the contribution of the humanities.

Danube: Future is coordinated by the Alpen-Adria Universität Klagenfurt and co-coordinated by the University of Trieste, the University of Natural Resources and Life Sciences Vienna and the University of Novi Sad. The Institute for the Danube Region and Central Europe is represented in the Management Committee. In September 2013 the project was approved as flagship project of priority area 7, Knowledge Society, of the EU-Strategy for the Danube Region. Together with DIAnet (Danube Initiative and Alps-Adriatic Network), a project of the University of Trieste funded by the European Social Fund, Danube:Future organizes in 2013-2015 three International schools on the sustainable development of the Danube Region.

The project targets all 14 countries of the Danube River catchment. It is a joint contribution of the Danube Rectors Conference and the Alps-Adriatic Conference, thus tapping the largest pool of institutionalized knowledge in the DRB. Using this pool in a co-ordinate manner, the project will generate a knowledge base for the DRB enhancing sustainable development by adding a humanities and social science perspective to current approaches to sustainability which often remain in the realm of natural sciences. The output will support the creation of green jobs and strengthen civil society organizations, thus enabling the DRB countries to cope with the Grand Challenges of the future and take steps towards a more sustainable development of their economies.

Key words: *Danube: Future*, sustainable development, interdisciplinary humanities, EU-Danube Region Strategy

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