PROCEEDINGS OF THE 41ST INTERNATIONAL ASSOCIATION FOR DANUBE RESEARCH CONFERENCE

ABSTRACTS

SIBIU, ROMANIA, 2016

The Proceedings of the 41st IAD Conference 2016, aim to communicate the extended abstracts of the 41st International Association for Danube Research Conference 2016, Sibiu, Romania, participants' recent advances in the aquatic ecology: rivers' tributaries biodiversity (aquatic, semiaquatic and riparian), value and threats; from mountain-tops to marine coasts, big rivers' tributaries state, restoration and conservation, big rivers' tributaries ecosystem services, big rivers' tributaries under climate changes, big rivers' tributaries and human impact, big rivers' tributaries structures and functions, big rivers' environmental history, Sustainable development, strategy and policy in Danube Basin.

ISBN 978-606-12-1303-0

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ORAL PRESENTATIONS ABSTRACTS

~ The 41st International Association for Danube Research (IAD) Conference, Sibiu, Romania, 2016 ~
- Tributaries as key elements in sustainable management of the Danube River basin -

STATE AND HUMAN INDUCED CHANGES ON RIVERS AND THEIR RIPARIAN ZONES IN THE LOWER DANUBE BASIN AND THEIR CONSEQUENCES FOR ECOSYSTEMS FUNCTIONING AND INTEGRITY

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Keywords: category of tributaries, interaction between rivers and riparian zones, human impact, habitat changes, site typical habitats and biodiversity

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Abstract

The different order of tributaries in the lower Danube river basin constitutes a large network and are differentiated by the altitude of their springs in the mountains or in the tableland hills, the length of the stretch in the respective relief unit, the density of their hydrographical network, the size of the basin or sub-basin and the climate of the crossed area. Even if the riparian zones characteristic for the rivers are considered frequently as azonal with existing similarities of the upper and the lower stretches, they presents as well differences from upstream to downstream and from one tributary basin to the other, being under the influence of the surrounding area and macro- as well microclimate conditions. Alone the Olt river with its length of 737 km and a basin of 24010 squkm have a changing hydrographic network of different density in function of the crossed relief units from the mountains to the Transylvanian Tableland, the Olt Depression on the foot of the Southern Carpathians, the Carpathian break area, the pre-Carpathian area and the Romanian Plain. Each of the tributaries, even if they have a low discharge and are of secondary, third or fourth ordre, is of importance for the riparian ecosystems and their functioning.

To examplify the great variety of tributaries, their ecological conditions and characteristic aquatic, temporary flooded and wet habitats, different type and orders of tributaries are analysed from the basin of middle Olt, Târnava Mare and the "Clisura", the gorge break stretch of the Danube through the Carpathians. In all these area a strong interaction exists between the water courses of different ordre and their riparian zones, these two parts of an ecological unit being of significance for the ecosystems quality. Due to human interventions such are rectification, river embankment, construction of weirs and power plants as well as land use changes, inflow of sewage waters, misuse for waste deposition, remarkable changes took place in the aquatic and riparian ecosystems.

The consequences for the natural aquatic and riparian habitats, as well as for the ecosystems functioning are visible between others through the disturbance of the hydrological regime, sectoral bed erosion, transformed mouth area with changed habitats due to backwater situation, loss of longitudinal and lateral connectivity with loss of hydro- and morphodynamic processes, which all together caused a decrease of size and quality of aquatic and riparian habitats as well as loss of riparian biocoenoses with site typical biodiversity.

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APPLICATION OF DYNAMIC WATER QUALITY MODELS TO SIMULATE NUTRIENT CYCLING AND AQUATIC PRIMARY PRODUCTION IN HETEROGENEOUS RIVER-FLOODPLAIN SYSTEMS

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Keywords: ecosystem functions, nutrient availability, aquatic primary production, water quality modelling, River Danube, floodplain.

Abstract

Floodplains connected to the main stem of the river are key areas for biogeochemical cycling in fluvial landscapes, playing a key role in nutrient retention and organic matter dynamics.

The Lower Lobau, a former floodplain of the River Danube southeast of Vienna, today represents a back-flooded lake system. The hydrological connectivity of the different water bodies ranges from 0 to 180 days per year. Nutrient availability and in consequence the aquatic primary production are depending on inputs from the main stem, as well as on internal release processes at the water-sediment boundary layer. This creates an aquatic ecosystem with high temporal and spatial heterogeneity.

Dynamic surface water quality models can be useful tools to study systems like the Lobau floodplain, with changing importance of different nutrient sources and biogeochemical processes. The high temporal and spatial resolution of such models, allows to simulate aquatic primary production and nutrient availability within different water bodies of the floodplain under shifting conditions and to study the ecological significance of their hydrological connectivity with the main stem of the river.

Therefore, we adapted the widely used water quality model DELWAQ (Deltares, The Netherlands), which is a dynamic compartment-modeling program for aquatic systems including both, the water column and the underlying sediment. Linked with a hydrodynamic transport model (DELFT3D, Deltares), 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 study functional processes and predict spatially explicit the trophic development and hotspots of biogeochemical metabolism under hydrological and seasonal changes.

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RESPONSES OF STREAM MACROINVERTEBRATE COMMUNITIES TO HYDROMORPHOLOGICAL DETERIORATION

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Keywords: benthic macroinvertebrates, hydromorphological changes, structural heterogeneity.

Abstract

Based on the relatively short time on which benthic macroinvertebrates respond to variation of environmental variables, they are used to assess the ecological state of lotic systems. Under the impact of different anthropic drivers, in particular hydromorphological changes like damming, flow modification and channel adjustments, the structural and functional heterogeneity of benthic macroinvertebrates in streams changes across space and time. Although it is widely recognised that the hydromorphological state influences the dynamics of benthic macroinvertebrate communities, empirical evidence does not necessarily support this affirmation. This research aims to explore the responses of benthic macroinvertebrate communities under the pressure of stream banks and bed modifications in terms of their structure. The research area is located in Prahova River Basin, Romania. The sites were pre-selected based on their similarity regarding catchment characteristics and in site physico-chemical parameters. The sites were classified a posteriori according to the type and extend of hydromorphological changes (pristine, moderate altered and highly altered sites). The methodology used encompasses physical, chemical, biological and hydromorphological components at different spatial scales (microhabitat, mesohabitat, reach and catchment). Macroinvertebrate communities are analysed based on different taxonomic adjustment methods. Here we show how the inclusion of hydromorphological components into streams ecological state assessment influences the results in contrast with the assessment based only on physical, chemical and biological components using multivariate statistical analysis. Also, we explore how structural heterogeneity explained by taxonomic richness, abundance and diversity is affected in sites with different types of hydromorphological impairments. The decrease trend regarding abundance and diversity is consistent at different taxonomic levels (order level for all benthic macroinvertebrates and species level for Ephemeroptera, Plecoptera and Trichoptera), whereas taxa richness shows an opposite tendency. Taxa identity and their percentage abundances are different in reaches along the same stream, as well as between streams. The results concernig the structural heterogeneity can not be explained counting only hydromorphological changes. They sustain the imperative need to correlate patterns occuring at different spatial scale and to better understand the mechanisms that undepin them. Elucidating the complex relationship between hidromorphology and the structure of benthic macroinvertebrate communities is a basic step to gain an insight into the assessment of functional diversity and resilience quantification.

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DOWNSTREAM MOVEMENT OF FISHES IN THE MIDDLE COURSE OF THE SKAT RIVER (NORTHWEST BULGARIA, DANUBE BASIN)

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Keywords: Danube tributary, lowland river, downstream fish migration, freshwater fishes.

Abstract

It is well known that in freshwater non-migrating (even non-rheophylic) fish species the regular downstream movements are substantial component of their life cycle. The knowledge of the patterns of these movements is useful for understanding and conservation of the integrity of river ecosystem.

The study was carried out in ice-free months from June 2014 to June 2015 downstream a weir in the middle course of the Skat River – a small right Danube tributary in Northwest Bulgaria. Its middle course is a typical lowland river with slow to moderate current, silty and sandy bottom, overgrown with bulrush and submerged vegetation.

At the sampling site once a month samples were collected along 24 hours period with conical ichthyoplankton net exposed in the spillway every 3-4 hours for 5-10 min. Water discharge, temperature and transparency were recorded. Species determination of migrating fishes was done and the intensity of downstream migration as individuals per 1 hour and individuals in 1 m^3 was determined. The features of feeding of migrating fishes were also registered.

For the period of investigations 9 fish species from 4 families (Cyprinidae, Cobitidae, Percidae and Centrarchidae) were found to move downstream as the cyprinids prevailed both in species number and abundance. Larvae and YOY predominated in the moving downstream cyprinids but other families were represented in the drift mainly by older specimens.

Downstream migration was found from April to September. The highest intensity of migration (an average 114 ind./hour represented by 9 species) was recorded in May 2015 but the most intensive migration as ind./m^3 was found in June 2014 (100 ind./m^3). From October to March no downstream movements of fish were found at all.

In diurnal scale the highest intensity of downstream migration was recorded during the day at low water transparency and during the night – at high transparency. At that the species composition of migrating fishes also changed.

The results of analyses suggest that the main environmental drivers for the seasonal dynamics of downstream movements of freshwater fishes are both the water discharge regime and temperature. The main internal factors are the ontogenetic stage and physiological condition of the individuals.

Diurnal fluctuations are dependent mainly on the possibilities of fish for visual or tactile orientation in space. In fish aged over 1 year a positive correlation between the diurnal changes of feeding activity and the dynamics of downstream migration was also found.

THE INFLUENCE OF DIEL PERIOD ON FISH ASSEMBLAGE SURVEYS BY ELECTROFISHING AND BEACH SEINING AT THREE LOCATIONS IN THE INSHORE PART OF THE DANUBE RIVER

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Keywords: diel period, electrofishing, beach seining, Danube, Serbia, Belgrade, Tekija, Prahovo.

Abstract

Assessment of fish populations and species assemblages is of great importance for fishery management as well as for monitoring environmental quality in freshwater systems.

Differences in fish activity, distribution and vulnerability to capture could have a great impact on the qualitative and quantitative composition of sampled fish.

The purpose of this study was to examine the influence of diel period on electrofishing and beach seining assessment of fish populations and assemblages along inshore locations on the Danube River. Additionally, this paper compares fish catch by beach seining and electrofishing to determine the relative catching efficiencies of the two methods.

Samplings were performed at three locations in the Serbian part of the Danube River (Belgrade, Tekija, Prahovo) in inshore areas with water depths up to 120 cm, from October 8 to October 11, 2012. At each location 4 samplings were performed: at 17:30, 18:30, 19:30 and 20:30. Values for wind speed, air temperature, barometric pressure, illumination, water temperature, turbidity, conductivity, pH, oxygen concentration, TDS and salinity were measured at each location.

Captured fish were processed quickly on site and released back into the water. A total of 910 fish specimens were caught and identified to the species level. Overall, 24 fish species were registered in the catch, with the highest number of specimens recorded at the Prahovo location. Numbers of collected fishes differed significantly between species and sampling periods. Species diversitiey was highest at 18:30 at all investigated locations. Fish abundance was highest for the18:30 sampling period at all locations, if data for A. alburnus are exempted. A. bjoerkna and N. fluviatilis were caught mainly by net while C. nasus and V. vimba were caught mainly by electrofishing.

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RESTORATION OF ECOSYSTEM FUNCTIONS AND EFFICIENCY CONTROL: CASE STUDY OF THE DANUBE FLOODPLAIN BETWEEN NEUBURG AND INGOLSTADT (BAVARIA, GERMANY)

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Keywords: Danube floodplain, restoration, ecosystem functions.

Abstract

As many rivers in Europe, the river Danube was straightened and embanked in the last two centuries. In the 1970s, the river was additionally dammed up by many hydropower barrages. So, the floodplain was disconnected from its river and thus the natural dynamic has been inhibited. Notwithstanding the hydropower dams, the restoration project is aiming to bring back natural water dynamics to the floodplain forest. Three measures were implemented: (1) construction of a new floodplain river (2) controlled flooding during high discharge in the Danube (3) groundwater draw-down in the floodplain during low discharge in the Danube. Since 2010, species and habitats typical for floodplains should be promoted by these regular disturbances. The results of a 4-year monitoring (runoff, groundwater, and soil moisture as well as fish migration and development of riparian vegetation) demonstrate the overwhelming role of dynamic water levels for the resilient floodplain ecosystem and its functions. A special focus of the contribution will be on the (im)possibility of management optimization of both aquatic and (semi-)terrestrial species. One of the main demands of the planning approval procedure was to foster the development of softwood riparian areas which are strongly protected by the European Habitats Directive. A second one is the provision of new habitats in the floodplain for fish and other aquatic species and the feasibility to migrate despite the hydro power dam – a demand of the European Water Framework Directive. The dilemma of an ecologically controlled runoff is that on the one hand as much water as possible is required for the fishes. On the other hand, however, a fluctuating water level and draw down for riparian vegetation types, especially for their new establishment, is needed. In natural environments the discharge of the main river regulates this matter naturally by its runoff conditions. If man is able to control the discharge of a side channel (to adapt the management) the two antagonistic requirements have to be brought into compliance. The contribution will discuss approaches to solve this problem and will give insight into the adaption strategies for future management. After five years of efficiency control, lessons learned will be presented and an outlook on restoration measures and floodplain management under European legacy will be given. Conclusions will be that a dynamic water discharge can initiate the re-establishment of typical floodplain functions, habitats and communities, but effects are restricted to a small corridor. To restore the whole floodplain of the Danube, more water has to be diverted for longer periods. Therefore, protecting the last remaining natural floodplain areas is the key task to maintain biodiversity in floodplains, and only then degraded floodplains need to be restored.

SOIL AND LAND-USE ACTIVITIES IN THE DANUBE REGION

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Keywords: Soil protection, land use management, EUSDR, public participation.

Abstract

Worldwide the surfaces that are degraded and are no longer suitable for agricultural production equal an area the size of the United States and Canada. Affected by this are approximately 1 billion people! And this negative development is continuing as the natural resource of land and soil is becoming ever scarcer: annually 7.1 million hectares of agriculturally productive land and 9.4 million hectares of forested land are lost through being built on, erosion and inappropriate or inept use. Due to a growing world population, the area available per inhabitant is diminishing rapidly: if in 1950 there was an average of 0.51 hectares available per capita worldwide, then in 2000 there was a mere 0.27. According to present estimates, in 2020 there will be only 0.18 hectares!

Soil campaign: "our soil – we stand upon it!" To achieve the purpose of soil protection, the Province of Lower Austria is backing a broad public relations campaign and raising of awareness on the subjects of land and soil and possible threats to them. By means of projects, lectures, exhibitions, presenting examples of considerate handling of land and soil, it is intended to address the communities above all, though both cities and communities have direct access to their local land areas and their exploiters.

The European Land and Soil Alliance (ELSA) is an association of cities, towns and rural districts together with comparable local and regional authorities with the aim of making an active contribution to sustainable soil use. The main strengths of ELSA lie in bringing together responsible politicians, experts and stakeholders at a European and inter-municipal level, with the aim of developing and implementing joint strategies for local authorities and regions.

The Province of Lower Austria joined the European Land and Soil Alliance as an Associate Member in 2003. Meanwhile Lower Austria is the leading region on soil protection in Europe representing 72 communities and additionally 14 associated members.
Currently ELSA has its about 200 members predominantly in Central European countries (Germany, Upper and Lower Austria, South Tyrol, Czech Republic, Slovakia) and is very interested in broadening its basis especially in the Danube Region.

ELSA invites all regions in Europe dealing with soil protection and sustainable land use to be part of a growing network and to implement best practise examples. By exchanging experience ELSA can contribute to realize the aims according to the action plan of the EU Strategy of the Danube Region amongst others.

LOTIC SYSTEMS CONNECTIVITY AN UTOPIA? CASE STUDY SOUTH-WEST ROMANIA

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Keywords: lotic systems, connectivity, fragmentation, fish, South-West Romania.

Abstract

Longitudinal connectivity is a condition for preserving biodiversity, self regulation and support capacity of lotic ecosystems.

This study assessed the lotic systems connectivity/fragmentation degree in the South-Western Romania. The study area of 360.000 ha included 19 protected areas: Ţinutul Pădurenilor, Semenic-Cheile Caraşului, Râul Nera între Bozovici şi Moceriş, Râul Timiş între Rusca şi Prisaca, Cheile Cernei, Cheile Nerei-Beuşniţa, Cheile Rudăriei, Cheile Teregovei, Dăncioanea, Coridorul Rusca Montană-Ţarcu-Retezat, Porţile de Fier, Rusca Montană, Munţii Ţarcu, Retezat, Nordul Gorjului de Vest, Grădiştea Muncelului-Cioclovina, Strei-Haţeg, Platoul Mehedinţi şi Domogled-Valea Cernei, including the following medium size hidrographical basins of the Danube tributaries: Nera, Cerna, Caraş, Bârzava and Timiş.

The analysis is based on the assessment of population status of fish indicator of the presence of natural habitats, of the status of specific habitats, and identification of the physical and chemical barriers that determine the anthropogenic lotic habitats fragmentation.

The studied fish species were: *Eudontomyzon danfordi* Regan, 1911; *Eudontomyzon vladikovy* Oliva and Zanandrea, 1959; *Salmo trutta* Linnaeus, 1758; *Thymallus thymallus* (Linnaeus, 1758); *Cottus gobio* Linnaeus, 1758; *Romanogobio uranoscopus* (Agassiz, 1828).

The fish populations status was assesses based on population size, balanced distribution of individuals on age classes, distribution area size, and percentage of individuals of the species of interest in the structure of fish communities.

The assessed biotope variables were: altitude, slope, riverbed width, depth, substratum type, presence of pools, riffles, runs and bends, water chemical parameters, riverin vegetation.

The fish populations vary in respect of degree of fragmentation based on various elements: ecological requirements, zoogeography, human impact, type of basin management, syinergisms, etc., the local specificity varying significantly from one lotic system/river basin to another and even from one lotic sector to another of the same river.

Restoring the intra-basinal as well as the inter-basinal connectivity represent both the objective and the solution for eliminating the fragmentation of any degree in the lotic systems of the studied area, which can not be achieved without a long-term approach and on long and very long distances regarding the main rivers of the studied basins.

For the studied fish species, the main lotic systems (râurile Dunăre, Timiş, Cerna, Caraş, Bârzava, Nera, etc.) are partialy active corridors in the present or have the needed restoring potential for that, to eliminate the existing cases of fragmentation.

The study was supported by "Southwestern Carpathian Wilderness and Sustainable Development Initiatives" financed through Swiss-Romanian Cooperation Programme

The authors thank to all volunteer students.

FOCUSED ACADEMIC COOPERATION IN THE DANUBE REGION – A NEW CEEPUS UMBRELLA NETWORK

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Keywords: CEEPUS umbrella, Danube Region.

Abstract

Within the Ceepus program „Aquatic ecosystem research“, (further Network) 14 universities and six further academic partners from 9 countries are involved in educational activities in the field of interdisciplinary aquatic ecosystem research. The network build on existing networks for scientists like the IAD (International Association for Danube Research www.iad.gs) as well as the CASEE network and topics are related to targets as outlined by successfully established EUSDR flagship projects such as conservation of endangered species, exploring sustainable ecosystem service and sustainable development by enhanced interdisciplinary and participative cooperation, developing innovative research infrastructure to meet future challenges in the field. The vast majorities of the states where the partner universities are located in the Danubian region and have already a diversity of programs related to aquatic sciences and river basin management in the field of natural, engineering sciences and environmental humanities, in particular environmental history. Still recent EU projects (EU FP7 project Dancers) identified major short comings in joint programs related to integrated river basin management for example. As pointed out in literature there is no coherent network related to training in aquatic sciences, water management and sustainable development in South East Europe. Progress in addressing the multi-layered environmental challenges within the Danube River basin and adjacent regions, including issues related to floodplain management and research also in sites outside the Danube River basin requires further aligning of economic, environmental and educational policies, advancing the EU Bologna Process across the region, and the development of dedicated training programs that combine technical and relational skills and foster a broader cooperation between research and educational institutions. The Ceepus network aims to address major challenges for inland and coastal waters and their management in East and South East Europe by an enhanced interdisciplinary cooperation of universities and research institutions in the frame of EUSDR initiatives and well- established scientific networks as well as intensified collaboration with various stakeholders with regard to the key issues outlined in the Danube River Basin Management Plan as well as for other River basin of partners in the network and to improve the scientific excellence in the region. A key aspect of the Ceepus network will be to support activities and aims of several EUSDR flagship projects (Danube:Future, Danubius-RI, DREAM and Sturgeon2020).

NETWORKING ON INVASIVE ALIEN SPECIES IN THE DANUBE REGION: DIAS AND ESSENIAS

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Keywords: Invasive alien species, networking, Danube River basin, strategy.

Abstract

The introduction and expansion of species with alien origin within the Danube River basin have been increasing due to human activities and global change. As a part of the South European Invasion Corridor, which links the Black Sea with the North Sea basin, the Danube River is one of the main routes for migration of aquatic alien species in both downstream and upstream directions. Alien species have been recorded among algae, aquatic macrophytes, macroinvertebrates and fish. Many of those species have negative environmental, economic and social impact. Networking on invasive alien species (IAS) in different scales may be very helpful in prevention and management of IAS and can facilitate the implementation of existing IAS instruments, such as the new EU Regulation 1143/2014 on IAS.

Here we present several joint initiatives related to IAS in the Danube Region (DR). Since 2012 a joint project on 'Potential threats to environmental and economic sustainability in the Danube and Black Sea Region: Danube River as invasive alien species corridor' has been implemented within the frames of the East and South European Network for Invasive Alien Species (ESENIAS) and the International Association of Danube Research (IAD). In 2014 the Danube Region Invasive Alien Species Network (DIAS) was established within the frames of Priority Area 06 of the EU Strategy for the Danube Region (PA 06 EUSDR), IAD, and ESENIAS. The aims of DIAS are to facilitate the transnational and international communication and cooperation on IAS in the Danube Region. Countries from the Upper, Middle and Lower Danube River basin, as well as adjacent Black Sea region participate in the network. DIAS strategy and work plan have been under development and it will cover seven key topics: Species and interactions/ impact; pathways of introduction; information system and knowledge dissemination; risk assessment and prioritisation; early detection and rapid eradication; management and restoration; and awareness raising and communication. These and other initiatives have demonstrated the strong necessity of cooperation and coordinated actions related to IAS in the Danube Region.

SPATIAL PATTERNS OF ZOOPLANKTON DIVERSITY IN RIVERINE FLOODPLAINS

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Keywords: beta diversity, spatial scale, environmental heterogeneity, connectivity.

Abstract

Understanding the spatial distribution of species diversity is a main interest of ecology and its relevance is enhanced under the current scenario of progressive diversity loss and massive change of ecosystems. Despite the relevance of spatial scale is increasingly recognized in biodiversity studies, there is still a lack of understanding on how combined environmental variations at smaller and broader scales influence diversity in a certain region. We studied spatial patterns of zooplankton diversity (rotifers, cladocerans and cyclopoid copepods) in riverine floodplains from the Upper Danube River in Austria, with the aim to understand how regional diversity is composed and assess the association between beta-diversities, environmental heterogeneity and spatial processes at different scales. We performed a field sampling using a hierarchical multi-scale approach, with emphasis on distinct vegetated habitats as hosts of zooplankton diversity. The sampling design included: 1- different habitat patches (open waters, submerged, floating-leaved and emergent macrophytes) to account for the variability within water sections and 2- different water sections along a gradient of hydrological connectivity with the main river channel to account for the variability among water sections in the floodplain wetlands. We included three wetlands within the Donau Auen National Park area, where river flooding is operative and one isolated wetland in an impounded section of the river. We performed the sampling once during summer 2014 after a flood event and once during dry summer 2015 when no flooding occurred. Our results indicate that regional diversity was very high and similar at flooded and non-flooded conditions. We found similar patterns for rotifers and crustaceans, with beta-diversities among water sections and among wetlands as main contributors to zooplankton regional diversity and minor contribution of beta-diversities among habitats. These patterns were similar in flooded and non-flooded conditions and we did not detect relationships between beta diversities and environmental heterogeneity at the studied scales. We used variation partitioning analyses to disentangle the roles of local environmental and spatial factors. Significant spatial effects at medium and fine scales in both flooded and non-flooded conditions suggest that massive dispersal related to floods produce homogenization of the communities and that these effects are persistent through time. In the isolated wetland with no flooding effect, we found a more even contribution of alpha and beta diversities to regional diversity as a result of increased beta diversity among habitats (compared to flooded wetlands). Our study suggests that in wetland systems with no regular flooding the lack of homogenizing effect determines that fine scale species turnover is high and significantly contributes to regional diversity, while in dynamic wetlands affected by river flooding, only medium or large scale species turnover are sufficiently high to significantly contribute to regional diversity. These results highlight the releveance of the spatial extent of dynamic floodplain wetlands for the mainteinance of regional diversity.

LONGITUDINAL CONNECTIVITY FOR FISH MIGRATION IN UPPER REACHES OF THE ISKAR RIVER AND PRIORITISATION OF THE RESTORATION MEASURES

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Keywords: Iskar River, connectivity, priority index, fish distribution.

Abstract

Physical obstructions in rivers are becoming increasingly recognized as major factors influencing the migrations, population structures, spawning success and recruitment of freshwater fish. River Iskar is a tributary of the Danube River and it is the longest inland river in Bulgaria. River Iskar is used for power generation, irrigation and drinking water. The upper parts of the river are inhabited by 20 fish species and some of them are rare or protected by various international and local laws and regulations. The aim of this study was to investigate longitudinal connectivity in the upper reaches of the Iskar River and its tributaries based on the assessment of the passability of each transverse structure in the river bed that might disturb natural fish dispersal. A set of hydro-morphological and physical parameters of each visual identified structure were measured using a methodology described by SNIFFER (2010). Each structure was measured twice - once in the spring high water period (May, 2016) and once in the period of low water (August, 2015). Data obtained from measurements are used to evaluate up-stream and down-stream passability scores for each fish species. Estimates are based on species characteristics (swimming and leaping ability) of each of the 20 fish species belonging to six families (Salmonidae, Cyprinidae, Cobitidae, Balitoridae, Centrarchidae and Cottidae) discovered in the study area. They are divided into five groups depending on their size and the maximum swimming speed. Invasive species are not included in the groups. Attention is paid on migratory species like Broun trout and Romanian barbell. In the upper reaches of the Iskar River and its main tributaries have been identified more than 105 transversal obstructions. Most of the fragmentations are artificial (88%) and built to support water abstraction, strengthening the riverbed or bridge foundations. They are categorized as vertical, stepped, sloping and combined and varying in high from 10 cm to over 5 m. Four of the structures are equipped with fish passes which have also been studied. Fragmentation density varies from 0 to 5,78 per km. Different restoration measures (removal of the obstacles and fish pass constructions) are discussed. The prioritizing of implementation of the proposed measures was performed by using two types of priority indexes – one for a total reach and one for a single obstacle. Basic criteria for prioritization were conservation status of the discovered fish species, the ratio between the total length of a river reach and the number of existing obstacles, height of the obstacles and the length of the river reach upstream and downstream the obstacle.

EXPRESSION LEVELS OF GENES POSSIBLY INVOLVED IN STURGEON SEX DIFFERENTIATION – PRELIMINARY STUDIES

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Keywords: stellate sturgeon, sex marker validation, quantitative PCR, sex identification of individuals in aquaculture.

Abstract

Sturgeons, the representatives of the *Acipenseridae* family, order Acipenseriformes, are a group of "living fossils" with high economic value due to their production of caviar. In aquaculture there is a need for early sex identification thus helping in the separation of valuable females from less valuable males. In this study we investigated some molecular markers that could prove useful in early sex identification for the stellate sturgeon (*Acipenser stellatus* Pallas, 1771).

We have selected 9 genes that are possibly involved in sturgeon sex differentiation (*ar, dmrt1, sox9, wt1, foxl2, cyp17a1, star, lh, igf1*) and described new markers for testing the differences in the expression levels of these genes. Aquaculture male and female stellate sturgeon individuals were sacrificed and white muscle, liver, kidney, gonads and anal fin clips were used for the analysis. The markers were validated through direct sequencing using the BigDye Terminator v3.1 Cycle Sequencing Kit (Applied Biosystems) and the ABI PRISM 3130 Genetic Analyser (Applied Biosystems). The expression levels were tested following the laboratory workflow that uses the iScript Reverse Transcription Supermix Kit (Bio-Rad), the iQ SYBR Green Supermix Kit (Bio-Rad) and the iCycler iQ Real-Time PCR Detection System (Bio-Rad) for quantitative PCR analyses (qPCR). The following reference genes were selected: *gapdh*, *28S rRNA* and *β-actin*.

The *ar*, *dmrt1, sox9, foxl2, cyp17a1, star*, *gapdh, 28S rRNA* and *β-actin* markers were validated through sequencing and NCBI BLAST analysis. Significant differences between male and female expression levels were observed through qPCR (p-value<0.05) for the *sox9* gene in white muscle and liver and also for the *cyp17a1, ar, dmrt1* genes in gonads.

This type of study is important for identifying a set of markers that could be used in early sturgeon sex identification of individuals in aquaculture. The advantage of early sex identification in sturgeons is an economic one for aquaculture and can have a positive effect on poaching, reducing the demand for black market sturgeon products.

TROPHIC STATUS AND PHYTOPLANKTON LIMITATION CONDITIONS IN SELECTED BULGARIAN AND HUNGARIAN DANUBE RIVER WETLANDS

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Keywords: Big rivers' tributaries state, restoration and conservation.

Abstract

Three wetlands of lake, two other of canal type in Bulgaria and two of most isolated from the Danube River in Hungary, which seem to assemble closer to Bulgarians were selected for a trophic status estimation and comparison between the two river territories.

The trophic state index (TSI) of Carlson (1977) based on phytoplankton chlorophyll-a (CHL), Secchi disk depths (SD), total phosphorus (TP) and total nitrogen (TN) concentrations defined the trophy of wetlands.

The wetlands and two more river stations in Bulgarian and Hungarian Danube sectors correspondingly were sampled in years 2009-2012 (Bulgarian) and in years 2012-2014 (Hungarian).

The comparison between difference of TSI of CHL and TSI of SD on one hand and TSI of CHL and TSI of nutrients (TP, TN) on the other reveals lack of phosphorus limitation for both groups of wetlands and more pronounced nitrogen limitation in Bulgarian wetlands than in Hungarians. This confirmed the previous findings (Kalchev et al. (2014), who reported higher TP and lower TN in Bulgarian than in Hungarian wetlands.

The most spring and autumn samplings in both wetlands and rivers sites seem to be limited by non-algal turbididty, while the summer samplings were closer to or truly nitrogen limited.

The wetland trophic status estimation by TSI of Carlson (1977) was difficult due to macrophyte growth, occurring in most of considered wetlands. Therefore even the selection of sampling dates without submerged or submerged floating macrophyte growth in the water area seemed to deliver unrealistic mesotrophic conditions. However in two cases the linear regression between percentage covered by macrophytes and TSI-ies calculated for one Bulgarian and one Hungarian wetland delivered an estimate of trophy beyond eutrophy which seems much more realistic than the mesotrophy. The abundant marcophyte growths hindered a reliable determination of trophic status and the attempt to overcome it by visual estimation of percentage of aquatic area covered by macrophytes, was only partly successful indicating the needs for more precise determination of macrophyte characteristics.

ENVIRONMENTAL ASPECTS OF IMPLEMENTATION OF MICRO-HYDRO POWER PLANTS – A SHORT REVIEW

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Keywords: micro-hydro power plants, economy, ecology.

Abstract

Micro hydropower can be a very cost effective and easy way for rural communities in developing countries and not only to acquire electricity. Proper locations do need to be identified. Both social and environmental risk need to acknowledged and appropriately managed. As well, a system or scheme needs to be installed that can accommodate the local energy needs but not be scaled too large to where the costs for larger system exceed what is needed and what is affordable for the local community.

Costs associated with installation are fairly reasonable and there are ways of significantly reducing costs by utilization of local labour. The use of local labour not only keep the price down, but also gives a sense of ownership to the community. This ownership will create inherent level of pride, which can be leveraged to the benefit for the longevity to micro hydro within the areas it is applied. Using local labour also creates the market for maintenance personnel, knowing how the system was built and operates, allows those who worked on the project to potentially gain employment as the individuals that maintain the systems.

The stimulation of small hydropower construction raised mixed feelings in society and caused social. To regulate the conflicts of interests between local communities, business and environmentalists, it is necessary to take into account the protected areas with high conservation value and principles of priority and expedience when making decisions and selecting sites for construction. These principles should be based on environmental criteria and should not go beyond the local and international legislation.

Last but not least should be highlighted that the wrong ecological approach or know-how in these projects implementation can be a major cause for which the ecological costs are sometimes higher than the economic benefit!

~ The 41st International Association for Danube Research (IAD) Conference, Sibiu, Romania, 2016 ~
- Tributaries as key elements in sustainable management of the Danube River basin -

LEARNING FROM PAST DANUBE DYNAMICS: HOW CHANNEL CHANGES INFLUENCE WATER AND GROUNDWATER LEVELS – THE AUSTRIAN DANUBE RIVER 1715-1821

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Keywords: Danube, chanel changes, 1715-1821.

Abstract

Anabranched and braided river systems are characterized by various multi-dimensional exchange processes. Today, hydrological connectivity between most rivers and their floodplain biotopes primarily depends on regular or episodic water level fluctuations driven by the flow regime. In human-unimpaired rivers, however, morphodynamic changes were also a basic factor that significantly controlled the hydrological conditions in river landscapes. The case study of the Austrian Danube River prior to channelization shows that sudden channel changes (avulsions) extensively affected the magnitude of above- and below-ground connectivity in riverine habitats. Between 1812 and 1817, the water and groundwater table dropped by approximately one meter in some parts of the floodplain, while other parts showed an uplift of the same dimension. Such changes in hydrological connectivity promote or limit the pathways of habitat evolution and the potential ecological succession. The historical analysis – focused on a larger spatial and temporal scale – shows that the changes in the water levels and depths of the groundwater table largely remained in balance. Such a quasi-equilibrium is also evident over the long term (1715-1821) when focusing on the spatial distribution of aquatic habitats. Although the natural river landscape experienced intensive fluvial dynamics, the range of variation in habitat patterns was surprisingly low.

The modelled connectivity conditions point to the high significance of active overflow and seepage inflow for floodplain ecosystems prior to channelization. Besides floods, also the long-lasting and large-area inflow from lotic Danube channels between low water and bankfull levels presumably promoted high planktonic primary production due to the nutrient-rich Danube water. Originally, hydrological disconnection phases only played a minor role. In contrast, today, due to channel incisions, flood-induced overbank deposits and the construction of levees the phases of hydrological disconnection between the lotic channels and the diverse floodplain biotopes are artificially prolongated. Such phases generally represent low or medium production environments when the isolated floodplain water bodies are primarily controlled by internal biological processes (e.g. denitrification, biological uptake, trophic interactions).

This study highlights the key role of morphodynamic processes for braided and anabranched river landscapes and supports the hypothesis that such river systems naturally feature “shifting habitat mosaics” as long as the controlling external factors (e.g. geology, climate, human interventions) do not change. The mosaic of habitats characterized by varying hydrological conditions and different morphological ages promoted species with individual ecological demands to co-exist in a highly dynamic riverine environment.

MOLECULAR MARKERS APPLICATIONS IN STURGEON CONSERVATION AND FISHERIES MANAGEMENT

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Keywords: sturgeons, molecular markers, stocks assessment, *ex-situ* conservation

Abstract

Caviar-producing sturgeons represent one of the most threatened fish group worldwide. Overfishing, poaching, habitat destruction and impairing migration routes had have brought these species to the brink of extinction. Mainly because of their important economic value the sturgeons are the target of both conservation and aquaculture programs.

The Lower Danube is currently the habitat of four sturgeon species: *Acipenser gueldenstaedtii*, *A. stellatus*, *A. ruthenus* and *Huso huso*. The monitoring of the wild populations from the river have demonstrated that urgent conservation actions are necessary in order to preserve the sturgeons from the Lower Danube, as these represent not only a natural treasure, but also a cultural heritage for the local communities. In the Romanian fish farms beside the four species of Danube sturgeons, exotic ones like *A. baerii* (Siberian sturgeon) and interspecies hybrids are raised.

The advance of the molecular biology field has led to the identification of molecular markers with great application in population genetics, conservation biology and aquaculture. Our aim was to conduct a molecular research on sturgeon wild populations and aquaculture stocks. Sturgeons present important challenges for genetic investigation due to polyploid ancestry. Thus, our efforts were directed toward the setup of a molecular markers panel having the following features: highly polymorphic, simply typed, appropriate for distinguishing the differences among closely related species and populations, suitable for pedigree analysis and populations structure inference. Our studies based on mitochondrial DNA and microsatellites analysis were focused on molecular identification of the species and hybrids detection, the evaluation of the genetic diversity and structure in wild populations and the assessment of the significant units for conservation. The analysis directed toward the sturgeons from fish farms aimed to infer the genetic variability of the aquaculture stocks, the early sex identification based on the expression level analysis of several genes presumably related with sex differentiation and the biochemical and molecular investigation of the effects induced by different stress factors.

The previous mentioned issues represent hot topics for conservation and aquaculture of sturgeons in which the molecular investigations have proven to be very useful. Thus, we can conclude that the genetic and biochemical studies of the Danube sturgeons are of highly importance to support the biological and ecological surveys in the effort to efficiently improve the measures for *ex-situ* conservation and profitable rearing in fish farms.

TROPHIC RELATIONSHIPS AND STATUS OF RESERVOIRS WITH AND WITHOUT OCCURRENCE OF *DREISSENA SPP. (MOLLUSCA: BIVALVIA)* BUILT ON BULGARIAN DANUBE RIVER TRIBUTARIES

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Keywords: Big rivers' tributaries, human impact.

Abstract

The substantial increase in mobility and all kinds of contacts of mankind around the globe during recent decades is leading to an intentional and non-intentional fast spreading of biological species far beyond their natural areal. Some of these species like *Dreissena spp*. are called invasive alien species due to their ability to strongly affect the biodiversity, habitat and functioning of aquatic ecosystems. This way they are affecting relationships and metrics developed for estimation of ecological status and implementation of Water Framework Directive of EC (Qualls et al. 2007, Arndt et al. 2009, and De Winton et al. 2012). One such metric widely used is the trophic state index (TSI) developed by Carlson (1977).

In this report we studied the trophic status and relationships between Secchi depth transparencies (SD), chlorophyll-a (CHL) and total phosphorus (TP) concentrations from 5 infested and 9 non-infested with invasive alien species *Dreissena spp.* reservoirs, situated on Bulgarian Danube River tributaries. Most of the data originated from the publication of Tosheva, Traykov (2012) but also from own measurements on Ogosta reservoir. Thus the two data sets include in total 9 samples from non-infested and 20 samples from infested reservoirs.

The original CHL and SD did, but TP values did not show statistically significantly difference between infested and in non-infested reservoirs by the test of Kruskal-Wallis. However, when applying the t-test the calculated trophic status index values after Carlson (1977) showed statistically significant differences for all three compared variables between infested and non-infested with *Dreissena spp.* reservoirs.

The three linear regression equations between SDxCHL, CHLxTP and SDxTP were statistically significant for the group of non-infested reservoirs, while for infested reservoirs only the SDxCHL regression was statistically significant for $P<0.05$. However, the slopes of SDxCHL regression in non-infested and infested reservoirs did not differ significantly (which might be due to low reservoir (replicate) numbers included in calculations) the percent of variations explained by this and other two regressions (CHLxTP and SDxTP) for invaded reservoirs was considerably lower than in non-invaded reservoirs.

Our results confirmed partly the findings of Oualls et al (2007), Atalah et al (2010), that the *Dreissena* invasion decreased or destroyed the predictive power of some ecological status indicators, or in our case the indicators of trophic status of Carlson TSI. The accurate application of this metric requires their further development by accounting for more or less strong effects the alien species exerted on invaded aquatic ecosystems.

EDUCATION FOR NATURE – A PRIORITY OF THE PROGRAM STURGEON 2020

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Keywords: environmental education, school children, Danube Region, sturgeon conservation.

Abstract

The environmental education plays a key role in creating the basic understanding on nature importance for human life and wellbeing, as well as for increasing the ability to take environmentally friendly decisions to ensure the sustainable development of the region. Therefore, this topic is widely acknowledged nowadays, being promoted by important international forums (e.g. UNESCO educational programs) or regional strategies such as the EU Strategy for the Danube Region (Priority Area 6 – Biodiversity, Priority Area 9 – People and skills). It represents also an important component of Sturgeon 2020 Program, a flagship project of EUSDR PA 6 devoted to sturgeon conservation in the Danube River Basin and the adjacent Black Sea, where measures highlighting the close connections between the Danube biodiversity – sturgeons populations – benefit of local communities, are foreseen as key tools of communication. Young children are the most receptive category of population given their capacity to understand and respond positively to environmental problems, and even by creating linkages with individuals from other groups (families, neighbours, friends).

The presentation will focus on two successful examples of environmental education for children (7-14 years old) and suggests possible actions to involve children in activities offering them the opportunity to see and feel the nature and the environmental work in a closer way. The event **„Another type of school"** (April 2016, Institute of Biology Bucharest) was devoted to primary class children to raise their awareness and knowledge regarding the importance of biodiversity and its major threats. The program comprised a variety of presentations, together with practical activities such as direct observations of living plants and animals (aquarium fish, sturgeons and turtles) and microscopic examination of biological structure and ultrastructure (different types of vegetal /animal tissues or bacterial cell samples). The second event was the celebration of the "**World Fish Migration Day"** held at the premises of "Grigore Antipa" National Natural History Museum (May 2016, Bucharest), and dedicated to children of different age classes. The presentations were focused on fish migration aspects and discussed in an interactive way with the participants. A movie on sturgeons migration and practical examinations of some aquatic organisms in relation to the fish fauna (aquatic plants and invertebrates) completed the event. For the youngest participants, a drawing and colouring contest took place at the end, aiming to spark their creativity and imagination to answer the question "How do you see a happy migratory fish?".

EFFECTS OF IMPOUNDMENT AND ARTIFICIAL SHORELINE HABITATS ON CARBON CYCLING IN THE DANUBE

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Keywords: Danube, impoundment, carbon cycle.

Abstract

Rivers do not just act as simple drainpipes, but are actually active players in the carbon cycle - a key ecosystem property - and large amounts of carbon and nutrients are not only stored in river sediments, but also degraded, transformed and mineralized due to microbial activity. However, like most large rivers in Europe and North America, the Danube has been morphologically modified for flood protection, navigation and hydropower production during the last century. Especially impoundments alter the sediment properties and hydrologic conditions of rivers to a large extent and therefore may also influence carbon and nutrient cycling. The Danube reach in and upstream of Vienna has been impounded since 1999, when the construction of the hydroelectric power plant Freudenau was finalized. To increase habitat diversity and river riparian connection, artificial shoreline habitats have been created in the impounded section at the same time. In contrast there is one of the last free-flowing sections in the Upper Danube downstream of Vienna, where shoreline habitats have been restored very recently.

Our aims were to study how the impoundment influenced the turnover and degradation of organic matter in comparison to the free-flowing section and whether the artificial habitats affected the aquatic carbon cycling positively.

In spring 2015, sediments and water of the free-flowing section, the impounded section, and three of the shoreline habitats respectively were analyzed for their nutrient and carbon stocks as well as carbon quality, microbial respiration, extracellular enzymatic activities, and algae and fungi biomass. Compared to the habitats in the free-flowing section and the impounded main stream, the sediments of the artificial habitats of the imoundment showed higher nutrient and organic carbon concentrations as well as algae and fungi biomass. Also the benthic respiration was highest in these habitats and showed similar values to fine sediment dominated streams. Additionally, the sediments in the shoreline habitats of the impounded section showed the biggest share of autochthonous organic material, which is considered as highly bioavailable. Extracellular enzymatic activities were highest in the impounded main stream reach. We found significant positive correlations between microbial activity and nutrient supply; besides, retention time had also a positive effect.

THE ROLE OF ALIEN SPECIES IN STRUCTURING THE BENTHIC MACROINVERTEBRATE COMMUNITIES IN THE OGOSTA RESERVOIR, THE DANUBE RIVER BASIN, BULGARIA

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Keywords: Alien species, benthic macroinvertebrates, abundance, Danube River Basin, North-West Bulgaria.

Abstract

Our previous studies showed the important role of some alien species, such as *Dreissena* species, in the distribution and trophic relations among benthic macroinvertebrates in infested water bodies. The goal of the present study is to investigate the composition and structure of macroinvertebrate community in the Ogosta Reservoir and the potential impact of alien species. The Ogosta Reservoir is located in the Danube River basin (North-West Bulgaria); it has surface area of 2360 ha and is used for irrigation, power generation, recreation and sport fishing. The samples were collected by standard hydrobiological methods at 5 sampling sites during the period 2009-2011.

A total of 42 macrozoobenthic taxa were recorded in the Ogosta Reservoir. They belonged mainly to Oligochaeta, Chironomidae and Mollusca. Among them there were two alien species *(Physella acuta, Dreissena bugensis),* and one translocated species (*Dreissena polymorpha*). The highest abundances were attributed to three groups: the mussels *Dreissena polymorpha* and *Dreissena bugensis,* the oligochets *Tubifex tubifex, Limnodrilus hoffmeisteri*, and the chironomid larvae of *Chironomus* gr. *riparius*, and *Chironomus* gr. *plumosus*. The contribution of alien species to the qualitative and quantitative composition of benthic macroinvertebrate communities in the reservoir, their role in providing food source and substrate to other benthic organisms, as well as their potential impact on native mussels are discussed. The results of the study will contribute to the assessment of water quality and water management in Bulgaria.

The study was supported by the Bulgarian Science Fund, Project DO02-283/2008, and the Financial Mechanism of the European Economic Area 2009-2014, Project ESENIAS-TOOLS, D-33-51/30.06.2015.

THE CRITICAL SITUATION OF STURGEONS IN TRIBUTARIES OF MIDDLE AND LOWER DANUBE RIVER

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Keywords: sturgeons, historic, middle and lower Danube Basin tributaries, significance and perspectives.

Abstract

Historic distribution, current status and potential for restoration of sturgeons in Austrian tributaries of the Upper Danube River has been already exhaustively treated by Friedrich (2013).

Being restricted to the Austrian rivers this study only provides data for the upper part of large middle Danube tributaries as the Mura and the Drava, and no data about the Tisza and Sava.

Hensel and Holcik (1997) are reviewing the historic and up to date distribution of sturgeons in the Upper and Middle Danube and its tributaries.

Although their historic distribution is mentioned already by Antipa (1909; 1933) and later by Bănărescu (1964) there is an alarming lack of scientific evidence of actual presence and use by sturgeons of major tributaries of the Lower Danube River, the Jiu, Olt, Siret and Prut Rivers.

The authors gathered and discuss here published and recent personal communication data on the occurrence and status of sturgeons in tributaries of the Middle Danube and recent personal communication data from tributaries of the Lower Danube River.

Most interesting are data about the presence of ship sturgeon (Acipenser nudiventris) in the Mura River (2005), the presence of beluga sturgeons (Huso huso) in the Jiu River (2001) and the presence of stellate sturgeon (A. stellatus) in the Siret River (2011).

The significance and perspectives of recovery of sturgeons in these tributaries is discussed.

A HISTORY OF PEBBLES AND SILT – FLUVIAL SEDIMENT TRANSPORT, HYDROPOWER AND TECHNICAL EXPERTISE AT THE AUSTRIAN DANUBE AND ITS TRIBUTARIES

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Keywords: Danube, tributaries, sediment.

Abstract

Sediment transport plays a key role for sustainable management of the Danube River. A 'disturbed' sediment regime has been identified as major obstacle for reaching the goals of the European Water Framework Directive. The current imbalanced situation regarding both bedload and suspended load can be attributed to multiple interventions in the Danube's catchment (e.g., agriculture, storage reservoirs, river regulation, torrent control), and not least to the chain of hydropower plants constructed along the river and its Alpine tributaries in the course of the twentieth century. Surplus of sediment on the one hand and deficit on the other threaten not only societal practices and technical arrangements to use the river, but also ecological functions of the fluvial system. At the Austrian Danube, some major research programs on this topic were carried out in the past three decades, after riverbed incision had been recognized as problematic in one of the remaining free-flowing sections. This contribution takes a longer-term perspective and looks especially at the role of technical experts, whose views and opinions on fluvial processes influenced where and how hydropower plants were built. Were the changes in sediment transport caused by and affecting hydropower really unexpected – or even unintended – by early planners and engineers, or rather consciously accepted with (technical) solutions in mind? How do past socio-natural interactions affect the implementation of such solutions at present? Drawing from various case studies of Austrian hydropower development in the twentieth century, both along the Danube River and its tributaries, the paper shows that the 'sediment question' engaged engineers almost since the first hydroelectric plants were planned and built. Technological progress, conflicting views about the optimal use of waters, and paradigm shifts in river management caused that actual outcomes differed from what those experts had envisaged (e.g., the hydropower chain at the Danube River was never completed). Rivers reacted to the weirs and dams that were built, and interfered with sediment transport, by adjusting their beds. From an environmental history perspective, resulting phenomena like reservoir sedimentation and riverbed incision can be approached as 'legacies' – long-term side effects from past human interventions into the fluvial system. These legacies limit the options for present and future river management. One important insight from such an approach is that current sediment problems go beyond purely technical and ecological questions. Especially in industrialized waterscapes, societal and cultural factors are decisive and thus important to observe; a more sophisticated understanding of specific actors and their motivations is needed to understand and manage sediment dynamics in the catchment of a great river like the Danube.

POSSIBLE EVIDENCE ABOUT RECRUITMENT OF BLACK SEA SALMON (*SALMO LABRAX* PALLAS, 1814) IN TRIBUTARIES OF THE LOWER DANUBE RIVER

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Keywords: Black Sea Salmon, Lower Danube River, tributaries.

Abstract

The Black Sea salmon (*Salmo labrax* Pallas, 1814) is an elusive, critically endangered species not listed in Annex II of the Habitat Directive 92/43 EEC but listed in the Red List of species of the Danube Delta Biosphere Reserve (Oţel 2000).

Historic distribution of this species by Bănărescu (1964) only mentions occurrence of young individuals in the Lower Danube River until Călăraşi (R Km 375). Oţel (2007) is discussing only its distribution in the Black Sea coastal waters and hypothesises its distribution in the Lower Danube to the Iron Gate II dams (R Km 863).

Updating information about occurrence and distribution in the Lower Danube River of this species, this paper extends the documented records to R Km 630 / Upstream of Corabia (June 27, 2008) and R Km 123 / downstream of Reni (June 16, 2016).

The possibility and the conservation significance that the “parr” (one year old specimen on its way to the sea) specimen captured upstream Corabia originates from the natural spawning in the Jiu River, the only tributary with Salmonid spawning habitats, is being briefly discussed.

IMPLEMENTATION OF DECENTRAL FLOOD PROTECTION MEASEUES

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Keywords: flood protection, river basin management, spatial planning, restoration, implementation, integrated landscape planning, public participation.

Abstract

Increasing floods have affected many people in all Danube region in the last decades and caused huge economic damages. The four major man-made reasons are destruction of flood plains including the clearing of flood plain forests, the drainage of most upstream springs and creeks, sealing of soils for construction purpose and intensification of forest manament with plantation of monocultures. This is what we contributed to raising flood events. Technical flood protection measures have been built since decades with huge effort, but the further perspectives are limited. So we need creative and innovative decentral measures in the whole catchment to reduce flood risks in future in cooperation of citizens, experts and authorities.

The first change of paradigm is that we have to think of flood everywhere: at the springs, in the forests, in arable land, pastures and grasslands, industrial areas, residential areas - and of course along the rivers and flood plains. For each of these sectors we already know what has to be done, but still lack the instruments to do on large scale. Restoration of spring areas, opening of drained creeks, re-establish natural tree communities along creeks in erosive forest monocultures. One of the most important aspects is improving of the soil structure in arable land by organic farming and composting. Long-term research has proved that even heavy rains of sixty millimeters can be absorbed, if we have treated the earth-worms well over years. Of course the protection of the still existing extensive grasslands and flood plains is crucial. We often underestimate the potential is flood protection in urban areas: industrial land does not necessarily mean that there is effective soil sealing. Twenty years of experience with roof greening show that 70 – 90 % of the rain fall can be kept on green roofs with 8 – 10 cm soil, which show the characteristic of steppic grassland. Other benefits are fine dust reduction, noise damping and a potential for species rich habitats for herbs, butterflies, bees and birds in urbanised areas.

To reach this ambitious aims it needs not only technical and ecological know-how, we need instruments to reach and motivate people in villages an cities. A long-term grass-root campaign in Upper Austria is presented that works with mobile exhibitions in municipalities and schools, expert workshops and regular training to manage an implementation on a wider level to reduce flood events for the future.

ANTIBIOTICS AND ANTIBIOTIC RESISTANCE IN AQUATIC ENVIRONMENTS: THE NEED OF COMMON EFFORTS TOWARDS A SUSTAINABLE DEVELOPMENT OF THE DANUBE – DANUBE DELTA – BLACK SEA AXIS

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Keywords: antibiotics, antibiotic resistance, Danube – Danube Delta – Black Sea.

Abstract

Antibiotics are successful pharmaceuticals used in medicine to prevent and treat infections caused by microorganisms such as bacteria and fungi. Their importance in medicine in the fight against infectious diseases accounts for their large-scale usage which in turn is associated with the emergence of microorganisms resistant to the antibioticss used against them. With the increasing industrial production of antibiotics and their human and veterinary use these substances have started entering the environment due to incomplete metabolisation in the organisms, incomplete elimination during sewage treatment, land application of animal waste, improper disposal of unused or expired drugs etc. Surface waters, groundwater, wastewater, soil, sludge, manure have been reported for contamination with antibiotics. They are regarded as persistent or pseudo-persistent because the rate of entering the environment is higher than the rate of elimination. The emergence of antibiotic contamination in the environment has direct and indirect consequences on microorganisms, plants, animals, and humans, thus antibiotics and antibiotic resistant bacteria are considered novel classes of environmental pollutants. In recent years, there has been an increasing interest in the occurrence and fate of antibiotics in the aquatic environment because it is still unclear if their presence in natural waters has contributed to the enhancement of antibiotic resistance amongst aquatic microorganisms. During an extensive field work campaign in May 2016, several lakes and Danube points were sampled to investigate the cyanobacterial diversity and toxicity and also the antimicrobial resistance phenomenon. A screening for the presence of resistance genes to several classes of antimicrobials was performed. It was observed that antibiotic resistance genes are widespread in the Danube and the Danube Delta, together with mobile genetic elements (integrons), a particularly well-studied genetic transfer element in environmental contexts. As high abundance of these integrons are linked to anthropogenic activity, their capacities to disseminate among bacteria, to confer adaptive advantages in changing conditions, and to utilize the environmental metagenome of gene cassettes, make them likely facilitators of environmental antibiotic resistance dissemination. The results underline the need of a thorough investigation of this phenomenon for designing cross-border strategies and policies for a sustainable development of the Danube – Danube Delta – Black Sea axis.

The study was supported by the EnviroAMR project, grant no. 3499/20.05.2015, financed through the EEA 2009-2014 Financial Mechanism, under the RO04 programme and by the Program PN47N/2016 Delta Dunării, Project PN16 28 03 01, financed through the National Authority for Scientific Research and Innovation (NASR).

POSTER PRESENTATIONS ABSTRACTS

BARBUS MERIDIONALIS RISSO 1826 ON SITE DECISIONS SUPPORT MANAGEMENT SYSTEM – A TRANSYLVANIAN NATURA 2000 SITE STUDY CASE

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Keywords: *Barbus meridionalis*, protected areas, Romania, fish species habitat neccesities, pressures, threats, management tools.

Abstract

The main inventoried threats to the fish species *Barbus meridionalis* conservation status in ROSCI0132 Natura 2000 site were: poaching, characteristic habitats modification, the river continuum fragmentation, the expansion of some invasive/more tolerant fish species, pollution, illegal spoil dumps, river regulation, riverbed overexploitation, liquid and solid flow regime of the river course. The pressures were: the characteristic habitats changing or damaging, poaching, water pollution, river continuum fragmentation, and deforestation of riparian vegetation.

Highly important for *Barbus meridionalis* protection are: the natural riverbeds morphodynamics preservation, the diminishing of the actual lotic fragmentation, avoiding riverbed overexploitation, the riverine vegetation conservation, the ecological reconstruction of the natural morphodynamic of riverbeds, an April-July fishing ban, poaching control, waste management, decreasing organic and chemical pollution, and the implementation of a seasonal permanent monitoring system for the fish fauna.

In this research was realised a basic model for management decisions in order to support the *Barbus meridionalis* conservation.

The ADONIS:CE was used in this research in the ecological domain, introducing a management model of *Barbus meridionalis* that contains its most important necessities regarding the habitat, the indicators that bring out a good ecological status – the accurate management to avoid and/or eliminate the pressures and threats which damage this fish species populations.

If the proposed management components do not succeed, this fish species will have a poor conservation status in the next 20-30 years.

This on site, on habitats and on species blueprint management decisions sustaining model for *Barbus meridionalis*, should be incorporated in an integrated management model for the ROSCI0132 site ichthyofauna, for this goal similar management decisions sustaining models for other fish species of European interest should be done.

Partially this research information was acquired in the study period for the project SMIS – CSNR 17049 "Pentru Comunităţi Locale și Natură – Bazele managementului integrat Natura 2000 în zona Hârtibaciu – Târnava Mare – Olt (PH+ PRO MANAGEMENT Natura 2000)".

30 YEARS AFTER THE FIRST INTRODUCTION OF ALIEN COREGONID SPECIES IN ISKAR RIVER

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Keywords: non-native fish, Coregonidae, Iskar Reservoir, Bulgaria.

Abstract

Coregonids (family Coregonidae) are cold-water adapted fishes common throughout the Holarctic in North America, Europe and Asia.

In Bulgaria, the coregonid species are non-native. According to literature data, in the 1980s, three species from the former Soviet Union (*Coregonus albula*, *Coregonus marenoides*, and *Coregonus peled*) were introduced to several Bulgarian reservoirs, such as Iskar, Dushantsi, Batak and Dospat. The introduction was made with the aim of diversification of commercial and recreational fisheries. However, there has been no any information about the process of acclimatisation and biological characteristics of those species during the last 30 years. The goal of the present study is to investigate the current state of the introduced coregonid species in Bulgaria.

The study was conducted in the Iskar Reservoir, located on the Iskar River, the longest Bulgarian river, tributary of the Danube River. The reservoir has an altitude of 817.5 m a.s.l., a maximum surface area of 3000 ha and a maximum water volume of 655.3 m^3x10^6. It is used for drinking and industrial water supply of Sofia city, the capital of Bulgaria, as well as for power generation, recreational fishing and water sports.

The fishing was made during the winter - spring period of 2015-2016, using gill nets placed in different parts of the reservoir. The fish were frozen and taken to the laboratory for identification and further analysis.

A total of 55 coregonid specimens were caught at four sites in the southeastern part of the reservoir, at sandy substrate, up to 15 m depth. 30 morphological features (meristic and plastic characters) have been investigated. The fork length of fish varied from 25 to 49 cm. The results obtained proved the existence of a self-sustaining population, and therefore, the successful acclimatisation of that coregonid species in Bulgaria. The results will be a basis for further studies on alien species traits and impact in the Bulgarian waters.

The study was supported by the Financial Mechanism of the European Economic Area (2009-2014), Program BG03 Biodiversity and Ecosystem Services, Project ESENIAS-TOOLS, D-33-51/30.06.2015.

NON-NATIVE FISH SPECIES IN UPPER REACHES OF THE ISKAR RIVER, TRIBUTARY OF THE DANUBE RIVER, BULGARIA

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Keywords: Alien fish species, Iskar River basin, Bulgaria.

Abstract

The long-term and growing human pressure in the Iskar River basin had a negative impact on fish populations, which has resulted in changes in species composition, abundance, population size and age structure. Recently, one of the main treats to fish populations has been the introduction, establishement and rapid spread of alien species within the entire river course. The current study was carried out with the aim to outline changes in fish species composition in upper reaches of the Iskar River with an emphasis on alien species.

The study area includes the upper tributaries of the Iskar River, the Iskar River main course and Iskar Reservoir. The samples from the main river and its tributaries were collected by electrofishing at 60 sites, with a length from 50 to 160 m, in the summer periods of 2012-2015. The samples from Iskar Reservoir were collected by gill nets at four sites, in the winter - spring period of 2015-2016, and by beach seining at 5 sites, in May 2016.

Twenty-one fish species, belonging to six families (Cyprinidae, Cobitidae, Salmonidae, Balitoridae, Cottidae, and Centrarhidae) were found in the main river and its tributaries. Five of them are alien (*Carassius gibelio, Pseudorasbora parva, Lepomis gibbosus, Oncorhynchus mykiss* and *Salvelinus fontinalis*) and one is translocated from the Aegean Sea river basin (*Oxynoemacheilus bureschi*). Twelve fish species were found in the Iskar Reservoir, among them three alien species (*C. gibelio, L. gibbosus* and *Coregonus* sp.). Some of the alien species were introduced intentionally to the river basin (*Coregonus* sp., *O. mykiss,* and *S. fontinalis*) mainly for diversification of recreational fisheries. Others, such as *P. parva* and *L. gibbosus,* were used as fish bait and most likely introduced to the river basin by fishermen. Some of the alien species (*C. gibellio, P. parva, L. gibbosus,* and *Coregonus* sp.) have established successfully, while others (*O. mykiss* and *S. fontinalis*) cannot reproduce and their populations have been maintained by regular stocking. Based on the results obtained about the qualitative and quantitative composition of fish fauna and share of alien species in the upper reaches of the Iskar River, the potential impact of alien species on native ichthyofauna is discussed.

The study was supported by the Sofia University Scientific Fund - Grant N 127/ 2016 and by the Financial Mechanism of the European Economic Area (2009-2014), Program BG03 Biodiversity and Ecosystem Services, Project ESENIAS-TOOLS, D-33-51/30.06.2015.

THE EFFECT OF *DREISSENA POLYMORPHA* ON BACTERIOPLANKTON, NEMATODE FAUNA AND THEIR RELATIONS TO ENVIRONMENTAL FACTORS IN OGOSTA RESERVOIR (DANUBE RIVER BASIN DIRECTORATE, BULGARIA)

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Keywords: bacterioplankton, *Dreissena polymorpha*, nematodes, Ogosta Reservoir, relations.

Abstract

Spatial, seasonal and annual bacterioplankton dynamics was studied for the first time (2009-2011) in five stations in recently infested by the invasive species *Dreissena polymorpha* Ogosta Reservoir. Possible relations with environmental factors, chl-a and *D. polymorpha*, and with Nematoda species composition, phytoplankton and zooplankton for shorter period, were tested for significance using statistical analyses. Bacterioplankton abundance and biomass decreased towards 2011 but were higher in spring in stations close to inflows of the main and other two rivers (ecotones) and in summer at the deeper layers with a maximum at thermocline, where organic matter and biodegradation increased. The smallest size class and free-living cocci prevailed over other morphotypes, but larger bacteria and bigger quantities of attached to detritus bacteria were found in 2009-2010 when the development of *D. polymorpha* was stronger, than in 2011. NH4-N, PO4-P, TP, turbidity, dissolved oxygen, COD, phytoplankton biomass and chlorophyll-a correlate positively, while pH, transparency, Ca^{2+} and zooplankton abundance correlate negatively with bacterioplankton. High water temperature favours bacterial growth (higher mean cell volume). Nematode species composition, studied for the first time, included 22 species (13 rare and one, *Rhabditis brevispina*, new for Bulgaria) belonging to 9 families. The nematodes were more diverse than previously reported in the river Ogosta and in other non-infested reservoirs, probably due to the favoring effect of *Dreissena*. *Monhystera stagnalis*, *M. filiformis* and *Dorylaimus stagnalis* were found in all stations. COD and oxygen saturation, are related significantly with the spatial diversity of nematode species. Negative correlations exist between total bacterioplakton number and *Tripyla glomerans*, *Tobrilus gracilis* and *R. brevispina*, supposing their bacterivorous feeding. The relation of *D. polymorpha* with transparency is strong positive and with nematode species is positive to *M. filiformis* and *Rhabditis filiformis* and negative to *Prodesmodora circulata*. The *D. polymorpha* impact is positive on phytoplankton abundance and negative on zooplankton abundance and bacterioplankton total abundance, but weak positive on numbers of larger bacteria, rods and attached bacteria, suggesting decrease of zooplankton pressure on these bacteria and larger amounts of dead organic matter released by the invasive species in the reservoir.

BACTERIOPLANKTON FROM TWO HUNGARIAN DANUBE RIVER WETLANDS (BÉDA-KARAPANCSA, DANUBE-DRAVA NATIONAL PARK) AND ITS RELATIONS TO ENVIRONMENTAL VARIABLES

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Keywords: bacterioplankton, wetlands, environmental variables, Hungary, Danube River.

Abstract

Seasonal and spatial distribution of bacterioplankton was studied in different sites of two oxbow lake type wetlands, densely covered by macrophytes and with different hydrological connectivity, namely Mocskos-Danube and Riha, first dominated by *Trapa natans* and situated in the active floodplain and the second with *Ceratophyllum demersum* dominance and located in the protected side of Béda-Karapancsa an internationally important high nature value and protected (Natura 2000) area, part of the largest active floodplain of the Danube-Water-System.

The investigations were carried out in 2014 from April to October altogether at six sampling times and parallel samples were also taken from the main channel of the River Danube at gauge of Mohács (rkm 1447), Hungary. The sampling dates were established according to the Danube water regime, given the fact that the downstream connectivity of Mocskos-Danube is around 550 cm. Physical and chemical factors, chl-a and macrophyte cover, measured simultaneously, were tested for relationships with bacterioplankton number, biomass and morphotypes by statistical analyses. The bacterioplankton development had a maximum in Mocskos-Danube increasing in sites moving away from the river inflow, followed by samples from Mohács distinguished by many detritus particles with attached bacteria in the deeper areas. The minimum was observed in Riha oxbow where the macrophyte cover was significant. The total bacterial number was highest in spring and the biomass in summer. Morphotypes and cell sizes differed significantly by seasons and sites with prevalence of free-living cocci. As expected, the DOC decreases with the increase of planktonic bacteria, because of its utilization. Furthermore, the correlations between the dissolved oxygen and free-living bacteria and between NH_4-N and attached bacteria are similar, negative. Direct relationships exist between bacterioplankton and temperature (with biomass and attached bacteria), suspended solids, pH, PO_4-P and chl-a. The lower bacterioplankton number in summer and autumn is probably connected with the increase of zooplankton pressure and competition with macrophytes and phytoplankton for nutrients.

FIRST RECORDS OF THE BLACK BULLHEAD *AMEIURUS MELAS* (RAFINESQUE, 1820) ALONG THE BULGARIAN SECTION OF THE DANUBE RIVER

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Keywords: alien fish species, *Ameiurus melas*, Danube River, first record, wetlands, Bulgaria.

Abstract

The black bullhead *Ameiurus melas* (Rafinesque, 1820) is native to Central and North America. It was first imported into Europe in France and subsequently in Germany in the 1870-1880s, and since then has established in many European countries, including those within the Danube Region. For example, in Hungary, the black bullhead was introduced with fish culture in the beginning of the 1980s, and escaped specimens spread rapidly along the Danube River, forming abundant stocks in most of the adjacent backwaters. In 2005, the species was reported for the first time from a side channel and a lake near Belgrade in the Serbian sector, as well as from the main channel near Drobeta Turnu Severin in the Romanian sector of the Danube River. Our goal was to study the occurrence and population status of *A. melas* along the Bulgarian sector of the Danube River.

Regular monitoring of alien species of benthic macroinvertebrates and fish in the Danube River basin in Bulgaria has been carried out since 2012. The fish were sampled by beach seine in the main channel, and by dip nets, fish traps, gill nets and electrofishing in the adjacent wetlands. For the first time two specimens of the black bullhead were recorded in the autumn of 2013 in the Srebarna Lake (shallow oxbow lake on the Danube River flooding terrace, between rkm 393 and 391). The fish were caught by gill nets and had a total length of 13.5 and 14.0 cm, respectively. In 2014 six young-of-the-year specimens with total length of 2.1-2.2 cm were caught by electrofishing in the discharge canal of the Malak Preslavets Marsh (Danube River floodplain, rkm 414) and in the adjacent section of the main channel of the Danube River. The presence of *A. melas* at both sites was confirmed in 2015 and 2016. The results showed that this species has established self-sustaining and abundant populations in some constant oxbow lakes and wetlands along the Bulgarian sector of the Danube River.

The study was supported by the Financial Mechanism of the European Economic Area (2009-2014), Program BG03 Biodiversity and Ecosystem Services, Projects ESENIAS-TOOLS, D-33-51/30.06.2015, and IBBIS, D-33-72/20.07.2015.

CANAL NETWORK DANUBE-TISA-DANUBE – THE SPECIFIC TYPE OF TRIBUTARY CONTRIBUTING THE DIVERSITY OF AQUATIC MACROPHITES IN THE DANUBE AND TISA RIVERS IN SERBIA

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Keywords: aquatic macrophites, Danube-Tisa-Danube Canal, Serbia.

Abstract

The construction of the canal network in Vojvodina (northern Serbia) begun in 1718, when the artificial bed of the Begej river was dug. In the period between 1793 and 1901, the basis of the hydro system was set, and after the WWII, Canal Network Danube-Tisa-Danube got its present form. Total length of main canals in the network is 930 km, including regulated former natural water bodies. The canal network connects to Danube at river km 1426, 1364, 1254, 1155, 1077, and to the river Tisa at river km 106, 79, 73, 65, 37, 10. The mouth of Tisa is on river km 1215 of the Danube. Although the main function of canal network is to improve agricultural land by regulation of water regime, ecosystem services provided are diverse - transport, fishing, recreation, sport, etc. According to many studies, the oldest sections of the network and former natural water bodies are wildlife oases inhabited by numerous plant and animal species with high conservational value. The lack of maintenance, particularly during the last decade of XX century, contributed to the biodiversity of canals. On the other side, high hemeroby level of these artificial water bodies, and pressures mainly from agricultural land on their banks, contributed to eutrophication, as well as to the occurrence and spreading of invasive species. Total number of 90 plant species was recorded during studies of the aquatic vegetation in the canal network, 100 in the Danube river, and 45 in Tisa. River courses were divided into units between confluences with canals. The analyzed section of the Danube river is between river km 1433 and 966 (Đerdap I dam). This section was divided into seven units: 1433-1426, 1425-1364, 1363-1254, 1254-1215 (confluence with Tisa), 1214-1155, 1154-1077, 1076-966. The analyzed section of the Tisa river was between river km 160 and 0 (confluence with Danube). It was divided into eight units: 160-106, 105-79, 78-73, 72-65, 64-63 (dam on Tisa), 62-37, 36-10, 9-0. Species composition and distribution were analyzed and compared between the canal and river unit downstream of the confluence. We have not observed any significant influence on the diversity of helophytes, while it can be concluded that canals contribute to the species diversity in rivers mainly as the source of free floating aquatic plants (e.g. Lemna, Spirodela, Azolla) and submerged species that are not anchored to the substrate on bottom (Ceratophyllum, Elodea). Due to floristic similarity, we can presume that the large number of other aquatic plants also originate and/or are transported through canal network into the river. The specific distribution pattern of invasive aliens Elodea canadensis and E. nuttallii emphasize the role of canals and their management in the control of invasive alien species. The record of new and potentially invasive species - Cabomba caroliniana in one part of canal network set the task for future monitoring of its distribution in the canal network, its potential occurrence in the Danube, and possible establishment in the Đerdap I run of the river reservoir.

MACROPHYTE HABITATS ALONG THE VUKA RIVER, A DANUBE TRIBUTARY IN CROATIA

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Keywords: macrophytes, habitat, Vuka River, Danube Basin, Croatia.

Abstract

Aquatic macrophytes are photosynthetic organisms that grow submerged below, floating on, or growing through the water surface. The vegetation of aquatic macrophytes is of great importance as a habitat for numerous animal organisms, such as diverse groups of aquatic invertebrates (molluscs, nematodes, arthropods) and vertebrates (fishes, amphibians, reptiles, birds and mammals), providing them with food, breeding site or refuge against predation. The area of the Danube River Basin in Croatia comprises 34965 km^2 or 62.5 % of the national territory. The length of the Danube course in Croatia is 137.5 km, from river km 1433 to river km 1295.5, which makes 5 % of the total Danube length. The Vuka River is a right side tributary of the Danube in Croatia, located in the south-western part of the Pannonian Plain. The total length of the Vuka River is 126 km, and catchment area is 1260 km^2. Its source is located at south-eastern slopes of Krndija Mountain near village of Paučje, while its mouth into the Danube River is located in the city of Vukovar, at river km 1333. The highest water level and discharge occurs in the late spring and early summer. Annual water discharge ranging from 0.001 m^3/s to 33.52 m^3/s. Most of the Vuka River course is located in the lowland alluvial plain, so it features an extensively meandering course. Some of the meander loops had been cut off in the past. In the recent years, restoration and revitalization activities are completed or planned for some old meanders. Near the village of Laslovo, an old meander of the Vuka River has been restored in length of 4.3 km. Field survey was carried out in the period from June to August 2015, on selected sites along the course of the Vuka River in Osijek-Baranja and Vukovar-Srijem Counties. The aim was to record presence and distribution of the macrophyte habitat types, and to make an analysis according to arrangement of habitat types in the Croatian National Habitat Classification. Following habitat types, with assigned code, were recorded as it follows. From class A) Inland surface waters and wetland habitats: A.3.2 Free-floating and submersed hydrophytes from the vegetation class Lemnetea; A.3.3 Rooted pondweed vegetation from the class Potamogetonetalia; A.4.1 Marshland vegetation of the class Phragmito-Magnocaricetea, consisting of stands dominated by *Phragmites*, *Sparganium*, *Sagittaria*, *Typha*, *Carex* and *Cyperus*; A.4.2. Amphibious vegetation from the order Cyperetalia fusci, mostly developed on dry muddy sandy bottoms. From class I) Cultivated non-forested land and habitats with weed and ruderal vegetation, habitat type with code I.1.7. Riparian nitrophilous and hygrophilous vegetation from the order Bidentetalia tripartite, was recorded.

ZOOPLANKTON DIVERSITY ON WETLANDS OF MIDDLE (HUNGARY) AND LOWER (BULGARIA) DANUBE BASIN, PARTICULARLY REGARDING ALIEN AND RARE SPECIES

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Keywords: zooplankton, middle and lower Danube.

Abstract

Zooplankton (Rotifera, Cladocera, Copepoda) community structure was investigated in different wetlands of Middle (Hungary) and Lower (Bulgaria) Danube Basin from 2009 to 2012 and 2014 in Bulgaria and from 2002 to 2004, from 2007 to 2009 and from 2012 to 2013 in Hungary. There were identified 213 taxa (124 Rotifera, 59 Cladocera, 30 Copepoda) from nine Bulgarian and eight Hungarian wetlands. Sixty-three taxa occurred only in the Hungarian wetlands, and fifty-three taxa were collected from Bulgaria alone. Twenty-six taxa were unique (occurred in only one wetland) in Bulgaria and thirty species in Hungary. Among the rare species, Daphnia ambigua, Holopedium gibberum and Monospilus dispar were specifically rare in Hungary and not presented in Bulgaria, till the Simocephalus congener and Brachionus bennini are not members of the Hungarian fauna and very rare in Bulgaria. Three non-native species were detected from the investigated wetlands. Daphnia ambigua and Pleuroxus denticulatus have been spreading from Western to Central Europe in the last few decades and have not found in Bulgaria yet. Daphnia ambigua is very rare in Hungary and occurred only in the Riha Lake (protected side of the Béda-Karapancsa floodplain) in our studies. Pleuroxus denticulatus introduced from North-America, occurs in Europe since the 1970s. In our study, this cladocera species firstly collected in 2003 then it was spread the whole active Gemenc-Béda-Karapancsa floodplain. Eurytemora velox is an euryhaline Copepoda species, migrated from the estuaries of the North Sea upstream of many rivers and from the Black Sea upstream in the Danube River. According to our results this species are more common in Bulgaria and its density are significantly higher than in Hungary, obviously because of the proximity of the Black Sea. In Hungary, it has persistent populations in our sampling area, but their contribution to floodplain biodiversity is still not significant.

AQUATIC MACROPHYTES IN GRAVEL PITS ALONG THE DRINA RIVER FLOODPLAIN (SERBIA)

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Keywords: The Drina River, gravel pits, macrophytes.

Abstract

Natural river floodplains are among the most biodiverse and species-rich ecosystems. Nevertheless, the moste of the floodplains have been heavily reduced by human activities. At least 90% of floodplains in Europe have disappeared through channel straightening and embankment construction. Secondary habitats, such as artificial lakes may create suitable conditions for aquatic biota. During the last century, the extraction of gravel in European river floodplains created 'new' wetlands - gravel pit lakes, which have an increasingly important role in the conservation of aquatic biodiversity. The aim of this study was to estimate the macrophyte richness, diversity, naturalness and rarity in the abandoned gravel pits along the Drina River floodplain. The research was carried out on the six gravel pits in the lower course of the Drina River during the summer months in 2015. Vegetation data were collected in accordance with the Pan-European standard for the sampling of the macrophyte vegetation in lakes, using the UKTAG LEAFPACS (Lake Assessment Methods, Macrophyte and Phytobenthos). The sampling was carried out at 100 m sectors, repeated 2–8 times per lake, depending on overall vegetation abundance and diversity. Total number of vegetation data records was 477. A total of 20 species were identified, of which the most frequent were: *Ceratophyllum demersum* L. subsp *demersum*, *Myriophyllum spicatum* L., *Najas marina* L. and *Potamogeton nodosus* Poir. The most abundant were invasive species *Valisneria spiralis* L., followed by *Elodea canadiensis* Micx., which was listed as highly invasive in the preliminary list of invasive plants in Serbia. However, gravel pits along the Drina River floodplain found to be suitable habitats for species which are on the European Red List of Vascular Plants (*Callitriche palustris* L., *Nuphar lutea* L. Sm. subsp. *lutea*, *Potamogeton nodosus* Poiret. and *Utricularia vulgaris* L.). The present Red List of Charophytes inhabiting the Balkan Peninsula reveals that more than 80% of these algae are to some degree endangered. Three species of charophytes were identified: *Chara globularis* Thuill., *Chara contraria* A. Braun ex Kutz. and *Nitella gracilis* Ag. Generarly, relatively high macrophyte diversity (Shannon-Wiener Index 2.28) and naturalness (abundance of native species 93.62%) stresses the importance of these habitats for macrophyte diversity in the whole catchment.

WHAT SHAPES PRESENT RIVERSCAPES AND THEIR FISH DIVERSITY?

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Keywords: Environmental history, Danube, fish, floodplains.

Abstract

Rivers are often perceived as linear ecosystems crossing the landscape. The current channelized systems which primarily serve as shipping routes, hydropower producers or drainage systems motive such impressions. However, historical maps show the large spatial extend, river systems had before having been tightened between dykes and fragmented by dams. The biggest changes happened since the 19th century, but rivers were modified for centuries to serve human needs. The transformation processes of riverine landscapes show common patterns, but they differ significantly when one takes a closer look in spatial and temporal terms. The morphological river type or climate conditions co-decided the type and intensity of societal interventions. But even more decisive for a specific river's evolution over the last centuries, was the specific combination and co-evolution of politics, economies and cultures with these environmental conditions on local and regional scales. Using written historical sources and maps, and sound knowledge of fish and river ecology this presentation will pursue past societal interventions into selected riverine landscapes. Focusing on environmental legacies, we will highlight how past societal activities effect present ecological conditions and future management options.

For the Austrian Danube we will demonstrate how the transport revolution of the late 19th century had and has long-term effects on current fish biodiversity and fish stocks. In a period when fish stocks declined due to river channelization fish supply of the growing city of Vienna could be retained and even releaved from local resources because railways enabled fast import of marine fish in large quantities. Fostering local stocks and fisheries became less important for governments which favoured other functions of the river. For the Viennese Danube and its vast former floodplains, we will elucidate how urban land demand and specific ownership and use rights created the current variety of land use patterns. Urban growth made the Danube floodplains in the late 19th century a valuable land resource resulting in densely populated urban areas. At the same period, the foundations for the current urban national park were laid. The latter received it´s final shape, however, due to economic activities of the 20th century. Finally, we use these studies to discuss methodological implications of interdisciplinary long-term socio-ecological research (LTSER) of riverine landscapes. This includes questions of data and source availability as well as their integration and analysis.

SABANEJEWIA AURATA (DE FILIPPI, 1863) SPECIES IN MARAMUREȘ MOUNTAINS NATURE PARK (ROMANIAN CARPATHIANS) ECOLOGICAL STATUS AND MANAGEMENT

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Keywords: Golden spined loach, habitats, human impact, pressures, threats, assessment, management.

Abstract

This specific study on *Sabanejewia aurata* maps the populations of this species in the Munţii Maramureşului Nature Park, and evaluates its conservation status. The study was carried out between January – July 2015, with samples taken from 370 sampling sectors.

To evaluate the distribution and habitat condition of Sabanejewia aurata populations, repeated quantitative samples of fish were taken from about 3 km below the spring location of each watercourse in the studied area, in sectors containing habitats likely to be inhabited by these species. The criteria used to evaluate the status of the studied population are: balanced distribution of individuals by age classes, population size, distribution areal size and the percentage of individuals of the species of interest in the fish communities.

The fish species *Sabanejewia aurata* is a characteristic indicator of habitat ecologic status in Maramureș Mountains Nature Park area, which varies in quality between reduced, average and good due to many factors. The general decrease in habitat quality in the studied area is the result of human-generated organic pollution and mining pollution.

Sabanejewia aurata is a moderately distributed species in the researched area of Vişeu River Basin. 55% of the studied lotic sectors of the Vișeu River where *Sabanejewia aurata* was found are in good conservation status. 30% of the studied lotic sectors are of average conservation status, and could be improved with medium-term restoration measures. 15% of the studied lotic sectors are in poor condition where long term restoration is difficult.

With the implementation of ecological rehabilitation of the upper Vișeu River, there is potential for significant improvements in water quality and a related increase in the status and distribution area of *Sabanejewia aurata*. However, if no action is taken, the effects of pollution in the area are likely to continue to negatively affect habitat quality and species populations.

These data were collected as part of the project "Inventarierea, cartarea și evaluarea stării de conservare a speciilor de pești din Parcul Natural Munţii Maramureşului (ROSCI 0124 Munţii Maramureşului)/Inventory, mapping and assessment of the conservation status of fish species of Munţii Maramureşului Nature Park (ROSCI 0124 Maramureşului Mountains)". Special thanks for the continuous support of the Munţii Maramureşului Nature Park Administration.

~ The 41st International Association for Danube Research (IAD) Conference, Sibiu, Romania, 2016 ~
- Tributaries as key elements in sustainable management of the Danube River basin -

NEW *SALMO TRUTTA* ROMANIAN HAPLOTYPES IDENTIFIED BY SEQUENCING THE D-LOOP CONTROL REGION

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Keywords: brown trout, D-loop control region, Romanian haplotypes.

Abstract

The brown trout (*Salmo trutta*, Linnaeus, 1758) is a member of *Salmonidae* fish family and has a wide distribution in Romanian mountain rivers. Its natural habitat is disrupted by various anthropogenic activities and in order to balance the fish population structure, restocking activities are being applied, often without prior knowledge of the individuals' genetic structure. Given this context, our study aims to analyse the genetic diversity of six Romanian brown trout populations from Romanian rivers using the mitochondrial D-loop control region.

We used anal fin clips from 147 individuals from the following six rivers: Ucea, Cârțișoara, Porumbacu, Avrig (tributaries of Olt River), and Bistra Mărului and Bârzava (tributaries of Timiș River). We isolated the DNA by using the classic phenol/chlorophorm protocol and used the D-loop specific primers (FST and PST) for PCR amplification, followed by Sanger sequencing. The data was analysed by using several Bioinformatics software such as BioEdit, DnaSP, MEGA6, Network and 294 sequences downloaded from the GenBank database.

We observed that the population pair Bistra Mărului and Cârțișoara had the lowest value for the Wright's Fixation statistical index (Fst) – 0,015 – suggesting a low genetic differentiation, while the highest value for this index was observed between the pair of populations formed by Bârzava and Ucea – 0,886 – suggesting a high genetic differentiation. The haplotype diversity index (Hd) had the lowest value for the Bârzava brown trout population – 0,15, while the highest Hd value was observed in the Bistra Mărului population – 0,895. When we compared our sequences to those downloaded from the GenBank we identified two new brown trout haplotypes and the phylogenetic tree showed that in Romanian rivers the majority of the haplotypes are Danubian, but there is one Atlantic non-native haplotype discovered in the Porumbacu river.

Our preliminary study presents the genetic diversity of several brown trout populations from six Romanian rivers, along with their haplotype distribution and diversity. In order to assess a more robust genetic analysis of the Romanian brown trout populations, further studies are being planned, including microsatellite analysis.

THE ASSESSMENT OF COMMUNITY INTEREST FISH SPECIES FROM PROTECTED AREA ROSCI0229 SIRIU

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Keywords: PAs Siriu, Romania, *Cottus gobio*, *Barbus petenyi*, conservation status.

Abstract

In the protected area ROSCI0229 SIRIU, part of European network Natura 2000, were named three community interest fish species: *Gobio uranoscopus frici* Vladykov, 1925 (Danubian longbarbel gudgeon), *Barbus meridionalis petenyi* Heckel, 1847 (Danubian rheophilic barb) and *Cottus gobio* Linné, 1758 (bullhead). The purpose of this study is to assess the conservation status of these community interest fish species from ROSCI 0229.

The PAs ROSCI0229 SIRIU, part of Buzau River basin, is framed as part of ecoregion 10 – Carpathian Mounts (Ilies, 1978) and as part of alpine bioregion, with a total surface of 5.747 ha. The hidrografic network of PAs ROSCI0229 Siriu, tributary to Buzau River, is a circular network composed by 9 streams which descended from the highest peaks, streams that have rather ephemeral flow. In spring (from late April to June) they are more active and formed gradually downstream tumultuous courses carrying large volumes of rock.

We investigated three river, Buzau River, Siriu River and Crasna River by doing fishing activity in June and September 2010. Investigated rivers were chosen to surprise heterogeneity of environmental conditions of the hidrografic network of PAs ROSCI0229 Siriu. A total of 14 fishing activities was made in 10 fishing stations in the summer of 2010 year. The sampling of fish was made by electrofishing, according to standard operational procedure. Electrofishing was carried out in a river stretch along a distance between a minimum of 80 m and a maximum of 165 m, with a fishing surface between a minimum of 557 m^2 and a maximum of 1750 m^2. From a total number of 193 fish individuals collected were recorded 49 fish individuals of *Barbus meridionalis petenyi* and 37 fish individuals of *Cottus gobio*. From the all three monitored rivers *Barbus meridionalis petenyi* was present in two of them and *Cottus gobio* was presented in all of them.

The assess of conservation status of community interest fish species from ROSCI 0229 faces several practical obstacles. Data on the occurrence and abundance of habitats and species are generally limited, and financial resources to increase these data are limited, such as the assessment of the conservation status was a challenging exercise. In order to establish the population status we used two analytical indices, occurrence and abundance of species. According to these analytical indices of population, we assessed favorable conservation status for *Barbus meridionalis petenyi* and *Cottus gobio* in the protected area ROSCI0229 SIRIU.
Even if the present conservation status is favorable, formulation of the conservation objectives is not a straightforward procedure. The surface area needed to maintain a favourable conservation status for all targeted habitats and species from PAs ROSCI0229 Siriu, greatly exceeds the surface area designated. Hence, one must decide which habitats and species are of greatest interest in this SCI.

~ The 41st International Association for Danube Research (IAD) Conference, Sibiu, Romania, 2016 ~
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A COMPARATIVE STUDY OF THE TROPHIC RESOURCES FOR PREDATORY FISH SPECIES IN THE LOW COURSE OF THE DANUBE

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Keywords: Predatory fish, trophic resources, inferior course of Danube

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Abstract

A trophic regime analysis of the consumers from any ecosystem, regardless of their level in the trophic pyramid, represents a necessary stage for the study of various ecosystems; thus, the quantity and quality of food resources for the predatory species can be a very useful indicator for the state of the analyzed ecosystem. The objectives of this study was: first, the analysis of the trophic available resources for certain predatory fish species in the inferior course of the Danube; secondly, the observation of seasonal variations that may occur in what regards the available food sources, and finally, the comparative analysis of the food regime for the same species in diferent places from delta: Danube: Borcea, Murigiol and St. George and three different lakes:Razelm (Sarichioi) Uzlina and Golovita.

A constant analysis of the digestive duct content was observed in the case of the following species: *Esox lucius* (L. 1758; **Esocidae**, Common-pike), *Aspius aspius* (L. 1758; **Cyprinidae,** Asp), *Silurus glanis* (L. 1758; **Siluridae**, Wels-catfish), *Perca fluviatilis* (L.1758; **Percidae**, Perch), *Stizostedion lucioperca* (L. 1758; **Percidae**, Pike-perch); in addition to these species, the digestive duct content was analyzed in the case of omnivorous-carnivorous species that occurred occasionally in captures and in the case of two small individuals (30-38 cm, captured accidentally) of *Acipenser ruthenus* (L. 1758, **Acipenseridae,** Sterlet).

Invertebrates (especially Amphipoda crustaceans: Gammaridea, Corophiidea and insect larvae: of dragonflies, caddisflies, plecoptera, Diptera – Nematocera) form the trophic basis for most carnivorous fish species, while small fish species such as *Gobio* (Gudgeon) and *Alburnus* (Bleak) genera, as well as Decapoda crustaceans form the trophic basis for predatory fish.

The study on the food consumed according to the size of the predatory fish has emphasized that the small individuals often feed on invertebrates (for example, the pike-perch and the common-perch feed on *Dreyssena*, asp feeds on amphipods and wels-catfish on decapods, astacidae and even Oligocheta worms); as the fish size increases, the stomach content includes only fish that could be identified (gudgeon and bleak), as well as matter in an advanced state of digestion. The analysis of the Ivlev index, calculated seasonally for each species, has recorded significant variations according to size and season; the food ingested in the digestive duct was in an advanced state of digestion in autumn (the percentage value reported to the total biomass of the digestive tract was between 18-27%), compared to May (when the percentage is between 38-52%).

ECOLOGICAL TRAPS NEAR DANUBE BRIDGES FOR THE NIGHT-SWARMING MAYFLY, *EPHORON VIRGO*

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Keywords: Ephoron virgo, mayfly, ecological trap, polarotaxis, phototaxis, water surface.

Abstract

Ecological traps are defined as short term changes caused by human activity, due to which individuals of a population follow an earlier adaptive behaviour and choose inappropriate habitat for their offspring generation. This may lead to the extinction of the population or to the drastic reduction of its abundance even if there are still enough appropriate habitats in its environment. Polarized light pollution, when the polarization of light deceives aquatic insects, forms a special group of ecological traps. Recently we have described a photo- and polarotactic ecological trap threatening the night-swarming mayfly, *Ephoron virgo* in the vicinity of Budapest. Prior to oviposition, the upstream flying female mayflies are guided by the horizontally polarized light reflected from the river surface, but when they encounter bridges crossing the river, they get trapped due to their phototaxis and polarotaxis.

The bridge acts as an optic barrier for the females, moreover, the thousands of thousand mayflies become trapped at the bridge lights and after getting exhausted, they oviposit on the water-mimicking, horizontally polarizing asphalt of the bridge. Our aim is to develop light sources attachable to the bottom of bridges in order to preserve the Danube mayfly population in the regions around bridges. These lights are going to be capable of keeping the mayfly swarms above the river surface because of the strong phototactic behaviour of the mayflies. Thus their eggs shall end up in the water as naturally should happen and the offspring generation will be conserved. Here we present the results of our experiments aiming to reveal the polarization dependence of the phototactic reactions of the *Ephoron virgo* mayflies and we introduce the idea of the conservation of mayfly populations by artificial light sources.

DDT CONCENTRATIONS IN FISH SAMPLES: AN OVERWIEW

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Keywords: DDT, organochlorines, priority index, fish distribution

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Abstract

Dichlorodiphenyltrichloroethane, or DDT, is one of the pesticides with the widest use in the world, with large quantities deployed for insect-borne disease control and for crop protection against entomological pests. Although considered as mildly toxic for vertebrates, due to its relative inability to penetrate the tegument and the need for a large quantity to be ingested in order to induce physiological effects, it has the tendency to accumulate in the environment (due to its large half-life period, of up to 30 years in certain conditions) and to bioaccumulate inside the food chains, reaching significant concentration in top consumers, including humans.

Because of their characteristics, water bodies are the most exposed ecosystems to DDT contamination, and the effects on aquatic biota, especially on fish, are of a great importance in environmental and health studies, due to the fact that fish are both on the top of aquatic food chains and an important part of human diet in a significant part of the world.

The aim of the present study was to gather all the accessible information regarding DDT concentration in fish samples throughout the world and to classify the information in order to identify:

a) the temporal differences between concentrations, pointing out the eventual data that will provide information regarding the half-life of DDT in aquatic environments;
b) the geographical distribution of the studies, revealing eventual gaps in the information due to insufficient studies;
c) the geographical scale of the sampling made, discriminating between patch, local, regional and national studies;
d) the place in the food chains of the investigates species, in order to identify information that will prove useful for calculating the concentration factors between the various links of the food chain.

The results showed that most of the studies are made at small geographic scales, being mostly case studies, and that North America and South Asia are the most studied areas in the matter, while Europe has a relative lack of information in the field.

~ The 41st International Association for Danube Research (IAD) Conference, Sibiu, Romania, 2016 ~
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WETLANDS AND LAND SNAILS – A COMMON GOAL FOR CONSERVATION

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Keywords: land snails, diversity, conservation, wetlands, green corridors.

Abstract

Land snails are among the most successful invertebrates in terrestrial ecosystems, including inhospitable areas such as deserts, arctic, and alpine habitats. Despite this apparent plasticity, they depend on sufficient amounts of water in order to maintain their activity. The control of water is central to the success of terrestrial gastropods as land animals. They lose large amounts of water from their integument by secreting the mucus. Although they are capable of sustaining relatively high rates of evaporative water loss, the impossibility of compensate for massive evapotranspiration by water intake could result in death. This is the reason that land snails from temperate area are particularly abundant in wetlands. In agricultural areas, the gallery forests are inhabited by a diverse malacofauna. This is mostly true for habitat mosaics that tend to be particularly important as they have diverse substrate and topography, and a wide variety of valuable sub-habitats, such as logs, bare ground, and standing water, as is the case of well-preserved gallery forests that are genuine green corridors preserving biodiversity and connecting populations.

Not just the general diversity of land snail communities is at risk by the loss of these habitats, but some endangered mollusc species are also related to wetlands. All the four terrestrial gastropod species present in our fauna listed in Annex II of Habitats Directive, namely *Drobacia banatica, Vertigo angustior, Vertigo genesii* and *Vertigo moulinsiana* inhabit some sort of wetlands. Thus *Drobacia banatica* is present in gallery forests and the species dispersal is related to its migration capacity along the river valleys. Conservation of river valleys may allow not just the species survival but also the gene flow between the populations of Romania and those at the edge of distribution area (from Hungary and Ukraine). The three whorl snails (*Vertigo spp.)* are even more related to wetlands, inhabiting fens, marshes and flood plains.

The assessment of land snail communities in gallery forests from central Romania revealed the significance of well-preserved habitats for the conservation of land snail species. The diversity decrease as the wood is cut, logs extracted and the original vegetation replaced. As regarding the four species of European concern, conservation of specific wetland habitats may be the key to preserving these species in Romania.

~ The 41st International Association for Danube Research (IAD) Conference, Sibiu, Romania, 2016 ~
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ECOTOXICITY OF THE ANTIBIOTIC SULFAMETHOXAZOLE TO FRESHWATER PRIMARY PRODUCERS - A COMPARISON OF LIMNIC CYANOBACTERIA, GREEN ALGAE AND MACROPHYTE SPECIES SENSITIVITY

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Keywords: sulfamethoxazole, ecotoxicology, antibiotic, species sensitivity.

Abstract

Sulfamethoxazole (SMX) is a bacteriostatic sulfonamide antibiotic of remarkable consumption amounts, e.g. 26.1 t/a in Germany in 2012[1]. Extensive research with model organisms like algae, micro-crustaceans and fish was done to uncover toxic effects of the pharmaceutical on aquatic species[2-9]. EC_{50} values of 125 mg/L in acute tests[9] and NOEC-values of 0.25 mg/L in chronic tests[2] with *Daphnia magna* were found. For green algae and cyanobacteria E_yC_{50}-values from 0.027 mg/L[2] to 3.2 mg/L[9] were published. The aim of the present study was to specify the ecotoxic potential of SMX to several photoautotrophic organisms. The present study confirms that cyanobacteria are the most sensitive organisms to antibiotics within the aquatic food web. Critical concentrations for *S. leopoliensis* are: $NOEC_y$(72h) = 0,25 mg/l, E_yC_{50}(72h) = 1,85 mg/l, $NOEC_r$(72h) = 0,25 mg/l, E_rC_{50}(72h) = 135 mg/l and for *Anabaena flos-aquae* $NOEC_y$(72h) = 0,04 mg/l, E_yC_{50}(72h) = 7,7 mg/l $NOEC_r$(72h) = 0,04 mg/l, E_rC_{50}(72h) = 46,5 mg/l.

The toxicity of SMX on the growth of cyanobacteria *Anabaena flos-aquae*, *S. leopoliensis*, the green algae *Desmodesmus subspicatus* and *Raphidocelis subcapitata* were tested according to OECD testguideline 201. The emergent macrophyte *Lemna minor* was tested under the OECD guideline 221 as well. All EC values are calculated based on analytical confirmed concentrations. Statistical analyses were performed by means of the software package ToxRat Professional XT, version 2.10 (ToxRat ® Solutions GmbH, Alsdorf, Germany). Dose-response relation-ships were fitted using probit-analyses and linear maximum likelihood regressions. Instrumental analysis of all concentrations tested was performed by liquid chromatography using a low pressure Dionex Ultimate 3000-LC system connected to a TSQ Quantiva™ Triple Quadrupole Mass Spectrometer with a HESI Spray source in the positive ESI mode (all equipment by Thermo Scientific).

Up to now no legally binding Environmental Quality Standard (EQS) is determined for SMX in European waters. However, quality standards for fresh water were proposed by the Swiss Ecotox Centre[11] and Nenzda[12]. These QS are based on tests with *S. leopoliensis* by Ferrari et al.[2] using a $NOEC_y$(96h)of 6 µg/L, and an E_yC_{50}(96h)of 27 µg/L. In contrast, our results are based on analytical confirmed exposure concentrations of SMX and the NOEC- and EC-values are 10 to 100 fold higher.Therefore it is indicated to integrate these new insights into a revision of the proposed QS.

ISBN 978 – 606 – 12 – 1303 - 0