

danube news

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donau aktuell

Editorial

Message from the president

Dear Readers,

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The IAD as a very active network is currently intensely involved in EUSDR activities and flagship projects such as the Sturgeon2020 project, developing various subprojects to secure the survival of our Danube sturgeons, and the DIAS initiative (DANUBE REGION INVASIVE ALIEN SPECIES NETWORK) addressing the challenges associated with invasive alien species. As part of changes in our board, we welcome Prof. Bernd Cyffka from the Catholic University of Eichstaett-Ingolstadt as new Country Representative of Germany and express our thanks for the strong support IAD always received from the past CR of Germany, Fritz Kohmann. More about Bernd Cyffka can be found in this issue. The



Thomas Hein, President of IAD

dynamic development of IAD is also underlined by a new ad-hoc expert group on Long Term Socio-Ecological Research (LTSER) and environmental history by Dr. Gertrud Haidvogl and Prof. Martin Schmid; a timely topic linking historical, social and environmental sciences.

Sadly, we have to express our deepest condolence for the families and friends of three outstanding and long term members of IAD who passed away: Mr. Huebel, Prof. Humpesch and Prof. Kohl.

New Country Representative and new Expert Group New IAD Country Representative for Germany

Bernd Cyffka: Floodplain Institute Neuburg/Danube, Catholic University of Eichstätt-Ingolstadt, Germany, e-mail:bernd.cyffka@ku.de



Figure 1: Hand-over of mandate from Fritz Kohmann to Bernd Cyffka (cyffka©2014)

Bernd Cyffka follows Fritz Kohmann as CR of Germany

Since January 1, 2015, Prof. Dr. Bernd Cyffka (head of Aueninstitut Neuburg/Donau – Floodplain Institute/Danube) is IAD Country representative of Germany. Dr. Fritz Kohmann (Federal Institute of Hydrology) handed over the mandate as CR of Germany in December 2014 (*Figure 1*).



Figure 2: Bernd Cyffka (right) and the team of the Floodplain Institute Neuburg/Danube (cyffka©2014)

Short CV Bernd Cyffka

Bernd Cyffka, born in 1959, studied Geography at Göttingen University in Germany. During his Diploma (1986) and PhD thesis (1991) hydrology was the main focus of his work and took place in German catchments. With his habilitation thesis (2000) he switched a bit more to landscape ecology; the field works took place in Russia. In 2005 he was appointed full professor for Applied Physical Geography at Catholic University of Eichstätt-Ingolstadt. In 2006 he was nominated as head of Aueninstitut Neuburg Donau (Floodplain Institute/ *Danube; Figure 2*).

Bernd Cyffka is elected member of the European Academy of Science and Arts, Class IV, Natural Sciences.

Research and Activities

From 2006 onwards his scientific focus is on floodplain ecology and floodplain/river restoration as well as on eco-hydrology, especially along the Danube around Neuburg in Germany, but also at other rivers. He was heading a five year monitoring project funded by the Federal Agency for Nature Conservation, Germany, called 'Monitoring of floodplain ecological processes and control of dynamics along the Danube between Neuburg and Ingolstadt'. The monitoring of the restoration success along the Danube is still ongoing. Furthermore Bernd Cyffka and the Floodplain Institute are currently involved in three other floodplain and eco-hydrological projects in Germany, Kirgizstan and China. There are also strong connections to the EU-project 'DANUBEPARKS – Network of Protected Areas'.

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- Video message from EU Commissioner for Regional Development Johannes Hahn on the occasion of Danube Day 2013. Online available: http://www.icpdr.org/main/ danube-day-2013

New IAD Expert Group: Long-Term Socio-Ecological Research (LTSER) and Environmental History

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Gertrud Haidvogl: Institute of Hydrobiology and Aquatic Ecosystem Management, University of Natural Resources and Life Sciences Vienna, Austria, e-mail: gertrud.haidvogl@boku.ac.at The Danube riverine landscapes have been the site of human interventions into land-cover, morphology and hydrology, challenging societies along its banks for millennia. The Danube river basin (DRB) exhibits a plethora of environmental



Figure 1: Reconstructed states of the Danube riverscape in Vienna in 1663, 1849 and 2010 from Hohensinner et al. (2013), Changes in water and land: The reconstructed Viennese riverscape from 1500 to the present, Water History 5, 145–172. Credit: Severin Hohensinner

problems, many of which are likely to be exacerbated by global climate change and other driving factors, both in the bio- as well as in the anthroposphere. None of these problems can be addressed without knowledge about human impacts on the river and the river's impact on humans over time.

The IAD-expert group "LTSER and Environmental History" links existing research and aims to break new ground towards integrated, interdisciplinary long-term and historical research and on the Danube from prehistory to the present. In such environmental histories, social and natural dynamics are of equal importance, because the main focus is their interaction. This requires the cooperation of several disciplines. The core interest of this group's interdisciplinary efforts is the comparative study of long-term socio-ecological developments in the DRB.

Long-term socio-ecological research, LTSER, was developed from long-term ecological research (LTER), taking into account that the study of landscapes and sites where human intervention has taken place and continues to take place is important for planning a sustainable future. Since the field of environmental history developed its own contours in the 1970s, pollution, environmentalism, climate, resource use and abuse and its environmental effects, the study of conservation history and, more recently, the environmental effects of war and the human body in polluted environments have been studied. An environmental history of the DRB necessarily has to combine many of these themes, taking the diversity of environments, societies and cultures along the river into account.

With their ability to integrate natural sciences and humanities, LTSER and environmental history are ideally suited to provide the community of Danube researchers with longterm case studies which allow to base management decisions on the firm ground of historical knowledge.

Core publictions

- Dealing with fluvial dynamics: A long-term, interdisciplinary study of Vienna and the Danube. Special Issue of the Journal Water History, Volume 5, Issue 2, July 2013. Open Access: http://link.springer.com/journal/12685/5/2/page/1
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Joint Danube Survey 3 – A scientific cruise

JDS 3: Hydromorphological survey

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Hydromorphological Survey for the JDS 3

Considering the River Basin Analysis (2005) and first River Basin management plans (2009) across Europe hydromorphological alterations were recognised as significant water management issues. This is also reflected in the updated River Basin Analysis (2013) and the upcoming update of the Danube river basin district management plan (2015) elaborated under ICPDR coordination for the Danube. The most significant pressures were defined as longitudinal continuity interruptions by dams and morphological alterations, lateral connectivity interruptions (loss of floodplains, bank reinforcements) and hydrological alterations. These alterations may cause the decline of species biodiversity, a reduced species abundance, altered population composition as well as the hindrance of species migration and the corresponding decline of naturally reproducing fish populations (in particular sturgeon species for the Danube River

itself). Alterations of sediment quantity and composition as well as sediment accumulation and erosion upstream and downstream of dams have also to be considered.

Methods

After the first overall hydromorphological assessment of the Danube during JDS 2 in 2007 (ICPDR 2008) a methodology oriented on the CEN standard (CEN "Water quality – Guidance standard on the assessment of hydromorphological features in rivers" EN14614:2004, CEN 2004; and CEN "Water quality – Guidance standard on determining the degree of modification of river hydromorphology" EN 15843: 2010, CEN 2010) was further extended by the authors and applied during JDS 3 to 10 rkm segments (241 assessment units in total). Aside from the overall assessment, the WFD 3Digit approach, a selection of relevant parameters applied for morphological, hydrological and continuity components required by WFD parameters were used during JDS 3.

In addition, for the first time a detailed in-situ measurement and sampling of hydromorphological parameters was possible for all of the 68 JDS 3 sites. This raised the quality



Figure 1: CEN-Overall assessment . Colour: assessment scheme classes. Numbers: number of 10 rkm assessment segments. Following the semicolon: percentage)

and reliability of the hydromorphological assessment in particular, and supports directly the assessment of the biological elements for water bodies under the WFD. The strongest link is given to the physical habitat description of fish, macrozoobenthos and macrophytes, by providing data on substrate composition, flow velocities, discharges and the width-depth variability of sites by detailed cross sections.

Results

Continuous longitudinal survey in 10 rkm segments

The CEN overall hydromorphologcial analysis (*Figures 1 and 2*) indicates that only 21% were recorded as "slightly modified", but 79% fell with class 3 ("moderately modified") or worse (class 4 and 5).



Figure 2: CEN-Overall assessment as bank visualization (left) and as a map (right). For the Danube Delta only Sulina branch is visible in the left diagram (RKM 0010 – 0150).

The overall picture is therefore split into a large part with non-satisfactory conditions and a significant part of totally altered Danube reaches. The highest class "1" (as equal to reference conditions) is absent from the whole river length.

Regarding morphology the CEN WFD-3Digit assessment *(Figure 3)* out of the 241 analysed 10 rkm segments 13% fall in class 2 (slightly modified), 39% in class 3 (moderately modified), 31% in class 4 (extensively modified) as well as 17% in class five (severely modified). For hydrology/flow regime and the continuity only the classes 1, 3 and 5 were assessed. For hydrology only 16% fall in the first class whereas class 3 with 50% and class 5 with 34% prevail. Regarding continuity, dams are located in 8% of segments (in total 18 dams), where two dams with functioning fish passes and partial sediment management (Vienna-Freudenau and Melk) fall in class 3, the rest in class 5.

Detailed JDS3 site analysis and assessment

The flow conditions, interpreted by discharge, mean velocity and velocity pattern allow important insights to the hydrological and hydraulic situation during the survey. Unlike JDS2 when discharge downstream of Iron Gate significantly increased (based on data of gauging stations), relatively steady low flow conditions prevailed in the Danube during entire JDS3 (*Figure 4*). Low flow conditions enabled better

> site description of the river morphology (in-stream forms, river banks and riparian zone).

Major changes of flow dynamics and sediment continuity along the Danube are caused by dams operated on the German - Austrian Danube (chain of dams), on the Slovak Danube (Gabčíkovo) and on the Serbian -Romanian Danube (Iron Gate). Danube dams create sections with flow deceleration due to impoundment, or acceleration just downstream of dams, if is the headwater of the next impoundment does not immediately follow, where deposition or erosion, respectively, prevail. These changes are reflected in the composition of the bed sediments, inducing significant hydromorphological alteration at several longer stretches of the Danube. Changes of flow dynamics caused by groyne fields or other in-stream structures can have significant but mostly local effect on hydromorphology.



Variability in flow dynamics reflects current suspended load and composition of the bed sediments. Considerable decrease of suspended sediment concentration values was observed along impounded sections *(Figure 5)*. Disruption of sediment continuity generates a deposition area upstream of the barrier and a lack of sediments in the downstream direction, usually related to ero-

Figure 3: WFD-3Digit assessment



Figure 4: Flow conditions (velocity, discharge) on JDS 3 and JDS 2 (discharge)



Figure 5: Flow conditions and suspended sediment load during JDS 3. Short green lines: location of tributaries.



Figure 6: Variability of flow pattern and river bed composition along the Danube

sion. The deficit of fine sediments downstream of the Iron Gate is obvious at a long section of the Lower Danube and the Delta. If fine sediment continuity (suspended load) is affected markedly by dams then the impact on coarser sediments (bedload) can be expected to be even higher.

Bed material interpreted by grain size distribution curves represents an essential source of information to identify changes in channel morphology. Bed sediments vary in the downstream direction, the coarse sediments of headwaters giving way to progressively finer alluvium as base-level is approached *(Figure 6)*. Composition of the river bed sediments, rate of downstream fining and sediment sorting provide important knowledge on river processes (erosion/ deposition) so they can be used as diagnostic tools mainly in case no specific bedload data are available.

Natural composition and downstream fining of bed sediments for the corresponding channel type and geomorphological environment have been changed dramatically along the entire Danube mostly due to disruption of sediment continuity and other human interventions (dams, dredging, in-stream structures, etc.). Extent of these changes is proved by a high variability of bed sediment size (*Figure 7*). Except for long impoundments where fine sediments are deposited (sand, silt & clay) there are localities mostly downstream of dams with highly sorted coarse sediments (missing fine fractions) that imply either bed erosion or some degree of artificial bed stabilization. Variation in bed material grain size shows even downstream coarsening instead of fining at Upper Danube. Better situation can be seen on the Middle and Lower Danube where composition of bed sediments is less altered and the downstream fining is already indicated. Nevertheless, the impact of two big dams (Gabčíkovo, Iron Gate) and other interventions is still evident.

Values of mean sediment size (D50) indicate slightly coarser bed sediments in the Lower Danube (without Delta) compared with the Middle Danube. This can be caused by lack of finer sediments trapped in Iron Gate and also by coarser sediments coming from tributaries. Only one sample taken from tributary mouth does not allow more comprehensive view on the function of tributaries in changes of the Danube river bed.

Conclusions

Results of in-situ measurements used for hydromorphological assessment improved characterisation and analyses of the hydromorphological conditions of the Danube, creating a basis for more reliable considerations on sustainable restoration actions. The hydromorphological database creates an excellent basis for further hydromorphological analyses. The assessment of pre-defined 10 rkm segments improves spatial and thematic resolution of the survey and the assessment based on a common methodology. It can serve as a solid base for the management requirements and monitoring over the next decades. There is an increasing need to improve "descriptive" methods of hydromorphological assessments in particular for large rivers as it should be more "physical process" based. Further the linkage of hydromorphologic parameters and biological response as well as monitoring efficiency should be improved. The first



Figure 7: Downstream variation in bed material grain size for the entire Danube (orange) and tributaries (yellow). D50: sediment mean size.

steps in this direction were already done by performing in-situ measurements on JDS 3.

The importance and strong impact of existing dams in particularly regarding sediment balance up- and downstream, but also the hydrological changes (e.g. due to potential flow regulations) should be matter of further basinwide investigations (sediment balance up- and in particular downstream of dams, detailed hydrological analysis downstream of dams).

Taking into account the situation of the large European rivers, which are severely altered to a large extent, it must be taken care that the remaining, less altered water bodies along the Danube will be managed considering the environmental objectives. In addition to morphological restoration measures, a management of the sediment balance is needed at Danube basin-wide scale. The prevention of fresh bank revetments and reinforcement to the absolute minimum is necessary. The continuation of restoration measures improving the hydromorphological conditions is needed to meet the good ecological status/potential along the entire Danube. Restoration of floodplains should be a long-lasting goal for ecological and flood mitigation planning.

The full technical report is available under ICPDR.org (ICPDR 2015).

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Towards a good morphological status of the Danube – Riparian Bird Species as Indicators

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River Dynamics as key for biodiversity

River dynamics and natural morphological processes are forming a variety of habitat structures, hosting characteristic species communities. Due to river regulation (embanking, dams etc.) these habitats in early stages of succession, such as steep loam walls, gravel islands or large scale sand banks, have become extremely rare all over Europe. Consequently, these habitat types have also experienced one of the highest rates of species extinction along the Danube. Only natural rivers with intact river morphology can host the full set of characteristic species communities.

As part of the ICPDR Joint Danube Survey 3, two bird species were monitored, having their primary habitat at rivers with intact natural morphological processes: the Little Ringed Plover *Charadrius dubius* inhabits large, bare, sparcely vegetated gravel or sand banks, laying its brilliantly camouflaged eggs on the blank sediment (Bauer et al. 2005a, Glutz v. Blotzheim 2001a); and the Sand Martin *Riparia riparia*, which burrows its nests into steep natural river banks – the result of active lateral erosion of rivers (Bauer et al. 2005b, Glutz v. Blotzheim 2001b). The survey was launched and implemented by DANUBEPARKS (www.danubeparks.org). DANUBEPARKS is the Network of Danube Protected Areas, having river morphology and restoration as a main task.

In this study the occurrence of Little Ringed Plover and/or Sand Martin per 10 km sections were set in relation to the hydro-morphological classes (Schwarz et al 2015), proving the significant correlation between the extent of hydromorphological alteration and the presence and absence of these indicator species. This should contribute to identify a threshold for a "good morphological status" of the Danube River.

Study Area and Methods

In 2011 and 2013, a Danube-wide survey of riparian indicator bird species (Little Ringed Plover and Sand Martin) was conducted, covering the whole Danube. In 2013, the monitoring was extended to parts of the tributary rivers (Drava, Sava, Prut, Mosoni-Duna), and in total 4,119 km were assessed in this year.

Faced with the large study area and permanent changes in water level, a simplified, flexible and efficient methodology was developed for this survey. The base methodology consisted of two surveys by small boats, one in May and one in June. All suitable habitats for both species were investigated, artificial areas (e.g. sand quarries) were not considered. For each site, the number of birds and breeding pairs were assessed (details in Schmidt & Frank 2012).

As a consequence of long periods of high water level (especially in 2013) or other obstructive conditions, it was not possible to accomplish two surveys per year in some sections. This fact was considered in the analysis.

Mapping was done in Arcmap 10 and Quantum GIS 2.2. The base map was thankfully provided by NaturalEarth. For analysingthe influence of the hydro-morphological alteration of the Danube based on the occurrence of Little Ringed Plover and Sand Martin, the results of the hydro-morpholo-



Figure 1: In slightly modified sections of the Danube (hydro-morphological class 2), bird indicator species occur to 89%. Stronger hydro-morphological alterations reduce the capacity of the river for characteristic species: only 30% of extensively modified sections host the indicator species. Natural sections (class 1) are extinct at the Danube.

gical assessment (Schwarz et al 2015) were correlated with the ornithological dataset. The analysis was done with the statistical software R (Version 3.1.0).

Results

In 2013, a total of 244 territories of Little Ringed Plover and 103 colonies with a total of 10,453 breeding pairs of Sand Martin were recorded. Mainly caused by the different water level conditions, these results differ strongly from the survey in 2011, where 369 territories of Little Ringed Plover and 22,817 breeding pairs of Sand Martin in 82 colonies had been surveyed (Schmidt et al. 2015).



Figure 2: The generalized linear model shows the probability of the occurrence of indicator bird species on 10 km segments in relation to the hydro-morphological class. In hydro-morphological class 1 – not existing any more at the Danube – the probability would be around 97%. Hydro-morphological alterations greatly decrease the biological potential, in particular between class 2 and class 3.

The occurrence of Little Ringed Plover and/or Sand Martin per 10 km sections shows a significant relation to the hydro-morphological conditions (*Figure 1*). In the hydro-morphological class 2 (slightly modified), the probability of the occurrence of one of the two species is about 89%. According to the equation of the generalized linear model, in class I (near-natural - reference condition; extinct along the Danube) the indicator bird species could even be expected with a probability of about 97%. Stronger hydro-morpholo-



Figure 3: Conservation of river sections of high morphological quality has to be priority, still existing on a large scale at the Lower and Middle Danube. Based on river dynamics, colonies and potential breeding sites of Sand Martin are key habitat structures in dynamic rivers. (photo (V. Koev/Persina Nature Park): Insert: Aesculapean Snake Zamenis longissimus foraging on eggs and chicks in a big Sand Martin colony in Bulgaria).



Figure 4: River restoration is needed to re-develop the potential for characteristic species, in particular in sections of hydro-morphological class 3 and 4. After large scale river restoration, the Donau-Auen National Park (Austria) hosts today – locally on 10 km segments – the highest abundance of Little Ringed Plover along the Danube. This underlines the big potential for river restoration in the Upper Danube, in particular in the last free-flowing sections. (photo: F. Kovacs/ Donau-Auen National Park).

gical alterations greatly decrease the "biological potential" of the Danube river for characteristic species, as shown for class 3 (moderately modified) by a limited probability of about 65%. In "extensively modified" sections (class 4) the probability of the occurrence declines to about 30%.

The generalized linear model (*Figure 2*) with binomial error structure shows a significant relationship between absence or presence of the species and hydro-morphological class as the predictor (values 2 - 4, analysis of deviance (Type II tests), Likelihood Ratio, $Ch^2 = 75.794$, Df = 1, p<.,001). The explained variance is almost 40% (Nagel-kerkes R²=0.37) and the model predicts the correct presence of Little Ringed Plover and/or Sand Martin in 83.6% of the cases (Predicted vs. Observed, cut-value =0.5).

Conclusions

The monitoring of indicator bird species stresses the high ecological value of river sections which are only slightly modified (class 2) or even in a better hydro-morphological status. Stronger hydro-morphological alterations reduce the ecological value and the capacity for biodiversity: already in class 3 (moderately modified) the probability of occurrence of one of the two species is reduced to about 65%, and the probability is dramatically reduced to about 30% in class 4 (extensively modified).

Consequently, conservation of natural and slightly modified river section (class 2) – in particular at the Lower Danube – has to be priority, considering the Danube River as backbone for biodiversity and Natura 2000 area along most sections. At moderately or extensively modified sections a focus on river restoration is needed to re-develop the full ecological capacity of the river. As first step, (potential) breeding sites of Sand Martin and gravel and sand islands as key habitats are priority subjects of protection, conservation concepts like the Danube Wild Island Habitat Corridor (WILDisland) should be further developed.

Acknowledgments

The large-scale approach of this monitoring was only possible due the intense cooperation of numerous experts. Local DANUBEPARKS partners coordinated the monitoring on the spot (D. Bandacu, L. Bogdea, S. Bozhinova, G. Costea, A. Gáborik, I.D. Grlica, V. Hima, G. Kiss, V. Koev, A. Kovarik, M. Melišková, M. Milenkovic-Srbulovic, T. Parrag, V. Petrova, A. Raluca, V. Rožac, R. Šakić, T. Schneider, R. Surovec, S. Tatai,

B. Tóth, M. Tucakov, I. Vasić), and 56 experts from 13 Danube Protected Areas implemented the fieldwork.

The interdisciplinary cooperation with Ulrich Schwarz and the JDS working group "morphology" was fruitful and created important inputs for this study.

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Danube macrophytes

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Introduction

Macrophytes are aquatic plants living in the littoral zone of rivers and lakes (Haslam, 2006), and are one of the five biological quality elements recommended by the Water Framework Directive (EC, 2000/60; WFD) for monitoring of water quality in standing and running freshwater. They are taxonomically composed of non-vascular plants (bryophytes – mosses and liverworts), vascular plants (angiosperms) and macroalgae (charophytes, filamentous green algae, etc.) (*Figure 1*). From a life-form point of view macrophytes can be divided into emergent (helophytes), free floating and submerged macrophytes (hydrophytes) and plants that can live on dry land and under the water (amphyphytes).

Littoral vegetation of rivers and lakes helps to reduce shoreline erosion by absorbing part of the wave energy and serving as habitat for all kind of animals (Kalff, 2001). Macrophytes trap particles and associated nutrients forming substrate for bacteria and periphyton. They are also feeding, breeding and hiding place for benthic invertebrates and littoral fish as well as a habitat for songbirds, amphibians, reptiles and mammals.

EU member states had to implement macrophytes in their monitoring survey and assessment and when appropriate bank vegetation can be included as a special indicator of the hydromorphological status of rivers. Therefore this survey tried to include as many elements of aquatic vegetation as possible, recording them both in the water and on the banks of the Danube River and in its main tributaries.

Methods

Macrophytes and other bank vegetation were sampled on six kilometres at each sampling site, three on the left and three on the right side of the river. One kilometre was one survey unit, comprising six survey units on each sampling



Figure 1: Moss - Fontinalis antipyretica; b) Fern – Azolla filiculoides; c) Angiosperm – Potamogeton pectinatus; d) Macroalgae – Cladophora glomerata.

site. The survey was conducted from a small boat assisted by GPS for exact designation of survey units. Thousands of landscape, vegetation and underwater photographs were made for documentation, all marked with coordinates. Plants were collected by hand where possible as well as with the rake on a rope or on a telescope pole. Bryophytes were stored in paper bags, while vascular plants and charophytes were stored in 50% ethanol or in herbarium. Determination was carried out n the field or later on in the lab with the help of stereo-microscope (magnification 10-63X), microscope (magnification 100-400X) and up to date identification literature.

In addition to a species list, supporting parameters were recorded for each survey unit separately: presence of impoundment, incoming tributary or discharge, current velocity and diversity, estimated turbidity and Secchi depth, shading, type of bank reinforcement, proportion of submerged and emerged (bank) substrate as well as the slope and proportion of vegetation type on the banks. Species data and additional parameters were recorded in field protocols.

Prior to analysis, data were grouped in ten River Sections according to Moog et al. (2006).



Figure 2: Proportion of plant groups in all River Sections of the Danube (Bry – bryophytes, Cha – charophytes, Pte – pteridophytes, Ang – angiosperms, Mac – macroalgae.)



Figure 3: Proportion of life forms in all River Sections of the Danube (Hyd – hydrophytes, Hel – helophytes, Amp – amphiphytes, WR – water related plants, CH – chance species.

Results

Species composition – taxonomical and life form approach

During the whole survey of the main channel and the tributaries 198 taxa were identified. They belonged to the following groups: bryophytes (35 taxa), ferns (4 taxa), angiosperms (150 taxa), charophytes (1 taxon) and other macro-algae (8 taxa).

Angiosperms co-dominated with bryophytes in the first four River Sections and completely dominated in the rest of the Danube (*Figure 2*). Pteridophytes occurred in the Middle and Lower Danube, but with discernible relative plant mass only in Sections 5 to 7 (3.3–5.5%) where the floating species *Salvinia natans* was the dominant species in the group. A higher proportion of macroalgae occurred in Sections 5 to 10 (3.3–27.7%) with *Cladophora glomerata* as the dominant species, while charophytes were identified only in River Section 8 with a single species, *Nitellopsis obtusa*.

Macroalgae (except charophytes) and taxa identified to the genus level were not associated with life-forms. Therefore according to this concept 44 species belonged to hydrophytes, 28 species to helophytes, 34 species to

amphiphytes, 40 species to the group of water related species and 35 species comprised the chance species.

Hydrophytes and helophytes were the dominant groups throughout the whole river course (*Figure 3*). A complete dominance of hydrophytes was recorded in River Section 7 with 82.6%. Amphiphytes and chance species were represented with smallest percentage, while water related species showed an almost constant value close to 20% through the whole Danube.

Characteristic aquatic and bank Danube plants

Moss species defined the aquatic plant community in River Sections 1 to 4 where Cinclidotus riparius, Fontinalis antipyretica, Cratoneuron filicinum and Amblystegium serpens contributed the highest share to the similarity between samples in one section. River Section 5 was characterized by the aquatic moss C. riparius and floating species like Lemna minor and S. natans, while in River Section 6 only floating species like L. minor, Lemna gibba, S. natans and Spirodela polyrhiza were characteristic for all samples within this section. From River Section 7 to 10 C. glomerata was the link between samples while other species of macroalgae varied for different sections. In River Section 7 other characteristic species were Potamogeton perfoliatus, Potamogeton nodosus and Ceratophyllum demersum while in River Section 8

other characteristic species were *Myriophyllum spicatum*, *Butomus umbellatus*, *P. perfoliatus* and *Potamogeton crispus*. *P. pectinatus* and *P. crispus* characterised River Section 9, while River section 10 was characterised by *P. pectinatus* next to the macroalga *C. glomerata*.

Among the bank plants in River Sections 1 to 4 only *Phalaris arundinacea* was characteristic for all samples in these sections. Other bank species contributing to similarity between samples within each River Section were for example *Petasites* sp. for River Section 1, *Rubus* sp. and *Lythrum salicaria* for River Section 2, *Eupatorium cannabinum* for River Section 3 as well as *Solidago canadensis* and *L. salicaria* for River Section 4. *Persicaria lapathifolia* and *Persicaria hydropiper* were two species that mostly contributed to sample similarity in River Section 5.

In River Section 6 P. *lapathifolia, Echinochloa crus-galli* and *Bidens frondosa* were characteristic species as well as *P. lapathifolia* in River Section 7. *Xanthium strumarium* was the species with the highest contribution to similarity between samples in River Sections 8 to 10, while next to it *E. crusgalli, P. lapathifolia* and *Alopecurus geniculatus* were characteristic for River Section 8, *A. geniculatus, Dichostylis micheliana* and *Cyperus glomeratus* for River Section 9 and *C. glomeratus* and *D. micheliana* for River Section 10.

Neophytes

Neophytes are plant species which are non-native to a geographical region but they were introduced in recent history. During JDS3, out of 25 recorded neophytes, four of them belonged to macrophytes: *Azolla filiculoides, Elodea nuttallii, Lemna turionifera* and *Vallisneria spiralis (Table 1)*. Other species belonged to the bank vegetation as species of open and ruderal habitats like *Xanthium strumarium* that was dominating on Romanian and Bulgarian banks of the Danube and sometimes pushed out other helophytes, or *Amaranthus blitum* dominating on the banks downstream Belgrade.

V. spiralis was the most abundant neophytic macrophyte detected during this survey, while other species were found only occasionally. It was a first record for Hungary at Szob, upstream Budapest. Later on it was sporadically present in the Danube in the vicinity of the tributary Velika Morava, but also very abundant downstream of the Iron Gate reservoirs.

Conclusions

In general, angiosperms were the dominant plant group in all River Sections. Bryophytes were the subdominant group in River Sections 1 to 4 and macroalgae were the subdominant group in River Sections 6 to 10.

The cumulative number of taxa identified in all three Joint Danube Surveys was 249 taxa. 80% of these taxa were identified again in JDS3, because of previous extended experi-

| Species | Origin |
|----------------------------|--------------------------|
| Abutilon theophrasti | Southern Asia |
| Ailanthus altissima | East Asia |
| Amaranthus blitum | Mediterranean region |
| Ambrosia artemisiifolia | North America |
| Amorpha fruticosa | North America |
| Asclepias syriaca | North America |
| Azolla filiculoides | Subtropical America |
| Bidens frondosa | North America |
| Buddleja davidii | East Asia |
| Datura stramonium | North and South America |
| Echinocystis lobata | North America |
| Eclipta prostrata | Tropics, Subtropics |
| Elodea nuttallii | North America |
| Fallopia japonica | East Asia |
| Helianthus annuus | North America |
| Impatiens glandulifera | Asia |
| Impatiens parviflora | Eurasia |
| Lemna turionifera | North America, East Asia |
| Robinia pseudoacacia | North America |
| Rudbeckia hirta | North America |
| Solidago canadensis | North America |
| Symphyotrichum lanceolatum | North America |
| Vallisneria spiralis | Tropics, Subtropics |
| Xanthium spinosum | South America |
| Xanthium strumarium | North America |

Table 1: List of neophyte species with their origin recorded during JDS3.

ence and because of the aim to identify bank vegetation in detail with regard to the hydromorphological status.

Bryophytes were the dominant aquatic species in River Sections 1 to 4, with *Cinclidotus riparius* as the most representative species. River Section 5 was a transitional section where both *Cinclidotus riparius* and floating species (*Lemna minor, Salvinia natans*) were present, while River Section 6 was mainly characterized by floating species (*Lemna minor, Lemna gibba, Salvinia natans, Spirodela polyrhiza*). In River Sections 7 to 10 characteristic species were of the genus *Potamogeton*, as well as *Ceratophyllum demersum* and *Butomus umbellatus*.

Neophytes were present throughout the whole Danube course. They were present on the banks to a greater extent than in the water, and and sometimes replacing the natural vegetation through dominance and abundance.

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News and Notes

Obituary to Hofrat Prof. Tzt. Dr. Werner Kohl



HR Prof. Tzt Dr.. Werner Kohl. Photo: Kavka

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Former Director of the Federal Institute of Water Quality, Honorary President of the Austrian Committee of the International Association for Danube Research (IAD)

On September 23, 2014 our highly respected colleague Prof. Werner Kohl died in his 87th year of age after enduring a long and serious illness. Born in Vienna, April 14, 1928, he completed his studies at the University of Veterinary Medicine in Vienna in 1961. There Prof. Kohl started his professional career at the Institute of Bacteriology and Animal Hygiene in 1962. By 1964 Prof. Kohl got employed at the Federal Institute of Water Quality in Vienna due to the initiative of Prof. Reinhard Liepolt, the founder of IAD, missioned for establishing and managing bacteriology as a major branch in the institute. Implementing easily applicable procedures for bacteriological water monitoring and assessment was among Prof. Kohl's remarkable merits. With his demand of not restricting the sampling to water alone, but taking samples of sediments, fishes, aquatic plants and biofilms, too, he highly improved the bacteriological classification of water bodies. In the sixties of the last century he emphasized the significance of animals (e.g. water birds, grazing animals, dogs) as a reservoir for Salmonella and other pathogenic bacteria and added knowledge on the hazard potential of contaminated waters for humans. Numerous scientific papers and lectures supported his efforts on monitoring recreational and bathing waters. A European Directive on the management of bathing water quality, fresh water as well as marine, by the European Union affirmed his foresighted intentions.

In 1983 Prof. Kohl was appointed Director of the Federal Institute of Water Quality, in Austria. He restlessly promoted the extension of the subject-specific fields in his institute to accelerate the interdisciplinarity of the monitoring and quality assessment of water bodies. In 1976 he finished his habilitation thesis "About the importance of bacteriological monitoring for the assessment of running waters, by example of the Austrian Danube River" (Arch. Hydrobiol., Suppl. 44, 4, 392-461, in German), considered as a pioneering achievement, and received the Venia Docendi for "Physiology and Ecology of Water Bacteria". In 1985 he was appointed Associate Professor at the University of Vienna.

In 1983 Prof. Kohl was elected as president of the Austrian Committee of the International Association for Danube Research, carrying this function until 1996 and supporting many scientific projects and scientific events. The Reinhard Liepolt Award for Danube Research was created by Prof. Kohl, still supporting scientific projects in the Danube catchment area. In 2013 Prof. Kohl was awarded "Honory President of the ÖK-IAD" due to his outstanding merits for the association and for his excellent human skills.

By the end of 1993 Prof. Kohl retired as director of his institution. With great engagement he then focused his interest on the historic development of waste disposal and water protection. All those who have known Prof. Kohl will treasure his memory.

Obituary Univ.-Prof. Dr. Uwe H. Humpesch



Univ.-Prof. Dr. Uwe H. Humpesch. Photo: Kavka

Martin Dokulil: Ex Institute for Limnology, Mondsee, Austria, e-mail: martin.dokulil@univie.ac.at

Univ.-Prof. Mag.rer.nat. Dr. phil. Uwe H. Humpesch died on 17 July 2014. The cause of death was pneumonia. His body was cremated and the urn containing his ashes was buried under a tree in the Central Cemetery of Vienna. He had been treated with chemotherapy for lung cancer over two years. Despite his serious illness, Uwe lived the life of a researcher until his very end. Shortly before he passed away, he still had planned a collection and sampling trip to an Austrian Lake.

Uwe Humpesch was born in Vienna on St. Patrick's day, 17 March 1943. His mother was Austrian but his German

father was then working in what became East Germany and so a return to Austria presented many problems that were eventually overcome. Uwe was one of five children with two older and two younger sisters.

Uwe began his studies in biology at the University of Vienna for the qualifications as a school teacher. After obtaining his Master degree, he returned to his former school at the monastery of Melk where he was teaching biology. He finished his zoological studies under the supervision of Prof. Gertrud Pleskot in 1971 with the thesis 'Autecological investigations of the developmental cycle of Baetis alpinus PICT., Baetis Iutheri MÜLLER-LIEBENAU and Baetis rhodani PICT. (Baetidae; Ephemeroptera)'. In the same year Prof. Heinz Löffler incorporated him into his team at the Institute of Limnology of the Austrian Academy of Sciences which was based in Berggasse, Vienna, at that time. Uwe remained in this Institute all his further life. He dedicated his entire life as a researcher mainly to quantitative ecology of benthic organisms in inland waters, with autecological problems as a focal point. His intense interest in the taxonomy of benthic invertebrates, mainly the mayflies, resulted in the publication of some basic key-books for identification and several important publications, some in close cooperation with colleagues from England.

During his many scientific activities, Uwe Humpesch had stimulated numerous projects. One of the most important one probably was the project 'Ecosystem Study Impoundment Altenwörth: Alterations caused by the hydro-electric power plant Altenwörth' within the framework programme 'Man and Biosphere'. Shortly after the relocation of the Institute to Mondsee, Uwe Humpesch did his Habilitation as a university lecturer for 'Zoology - Limnology' at the University of Vienna in 1982 and later became a university professor, having his own lectures, courses and PhD students.

When conflicts arose over the construction of the river barrage at Hainburg, Uwe became member of the Ecology Commission of the Federal Government as an expert.

Uwe also had a strong social commitment. He was union representative for the staff of the Austrian Academy of Sciences from 1984 until his transfer to retirement in 2008.

Uwe Humpesch was also instrumental in the founding of the 'National Committee for Danube Research' (ÖN-IAD) in 1975 as national spin-off from the International Association for Danube Research. In this Panel, he repeatedly set important accents. Much of his activities are posted on the webpage of the ÖK-IAD under 'Historic' http://www. oen-iad.org/index-de.html

Among the numerous honours dedicated to Uwe Humpesch, the Theodor Körner Award, the Reinhard Liepolt Award for Danube Research and, particularly important, the Golden Medal for services to the Republic of Austria shall be mentioned.

Obituary to Klaus Hübel



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Klaus Hübel. Photo: Kopf.

Deeply saddened we have to announce the death of Mr. Klaus Hübel. He passed away Okober 30, 2014, at the

age of 74. He was a long-time member of IAD and headed the Expert Group 'Radio-Ecology' for many years. Some of you met Klaus for the last time when he attended the 4th Joint IAD Country Representatives & Expert Group Leaders Meeting in Vienna, April 24–26, 2005. He retired two month later in June 2005. Klaus was deeply related with the IAD Community, in combination with an excellent standing in his field of professional activities.

Now he is gone, but not forgotten. Our deepest sympathy to his son.

Rejuvenating Danube river banks

Pilot Study 'Bad Deutsch-Altenburg' (viadonau / Danube National Park; Austria). Photos: Janauer



Rip-rap originating from river regulation (19th century).



Danube River banks near Deutsch-Altenburg



danube news

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International Association for Danube Research (IAD)





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