ISSN 2070-1292

danube news

Bulletin of the International Association for Danube Research (IAD)
Informationsblatt der Internationalen Arbeitsgemeinschaft Donauforschung (IAD)

donau aktuell

Editorial

Dear Readers,

Following a long and highly successful period as Danube News editor, Jürg Bloesch expressed his wish to focus on new activities, and on current ones he never was able to devote himself more intensively, e.g. the highly important Sturgeon topic in the Danube basin. After evolving consultation with IAD President Thomas Hein I was finally persuaded to take on the very demanding activity of editing our IAD journal Danube News. Of course my start was made easier through extremely helpful instructions by Jürg, who let me learn from his long-term experience in editing our journal, which I most gratefully acknowledge.

Danube News 27 presents not only a message from the presidium, but also reports from several Country Representatives and Leaders of Expert Groups. These contributions reflect activities within IAD structural units. EURONATUR was so kind to provide us with a look back on one of the

Georg Janauer, Editor of DN

dominating conservationists in the Danube Basin, Martin Schneider-Jacoby. Interesting scientific topics are also covered, among others it is Sturgeon, aquatic viruses, and nitrogen in wetlands. Finally readers find a chapter on News and Notes, which comprises a short look into a macrophyte-modeling PhD thesis, carried out at BOKU (University of Natural Resources and Life Sciences, Vienna).

Georg Janauer
e-mail: georg.janauer@univie.ac.at, Photograph: ÖWAV

Message from the presidium of IAD

Harald Kutzenberger, Ivana Teodorovic, Thomas Hein:
General Secretary, Vice President, President of IAD;
e-mails: h.kutzenberger@tb-kutzenberger.com; teodorovic@beocity.net;
thomas.hein@boku.ac.at, Photograph: T. Hein

DanubeNews Volume 27 starts with a new editor, Prof. Georg Janauer and opens some windows to recent activities of expert group leaders and country representatives. The idea is to make the activities of our experts more widely recognized. Georg Janauer is a well-known macrophyte expert, even beyond the boundaries of the Danube River basin, and our association highly appreciates his efforts to continue with Danube news. Thanks, Georg!

We also want to express our deepest gratitude to Juerg Bloesch, who was editor of Danube News since the year 2006 and developed our journal to an outstanding information medium published twice a year covering hot topics in the

Thomas Hein, President of IAD

Danube River basin. We thank him for all his efforts and his ongoing active role in several key issues in the Danube River basin, such as the discussion on future hydropower development and contributing to the Danube Sturgeon Task force.

Currently an intense discussion can be observed in the Danube River basin, mainly driven by the EUSDR and all the opportunities and hopes related to this strategy. Members of IAD are contributing to several initiatives and projects under the umbrella of EUSDR. The EUSDR is not the only issue where IAD members are active – we are involved in the

discussion on guiding principles on hydropower development, we are one of the core institutions founding the Danube Sturgeon Task Force devoted to safe key species of the Danube River and the Black sea environment – the Danube Sturgeons. There are even more strong signs from experts of IAD – several members are joining the Joint Danube Survey III in August and September 2013, another example of the fruitful cooperation with ICPDR for a sustainable future of our river and its catchment and coastal areas. Furthermore, the preparation of the next, the 40th, IAD conference started recently and we are happy to announce the next meeting to be held in Sofia in the year 2014. More information will follow soon!

Still there are more challenges ahead for our Danube and the knowledge and expertise of our members is highly appreciated to identify science based solutions for the future development. In line with these needs and opportunities we wish all our members the energy and creativity to make significant contributions!

IAD Reports – Country Representatives (CR) and Expert Group Leaders (EGL)

CR Switzerland

Edith Durisch-Kaiser: Cantonal Agency for the Environment, CH-8005 Zurich, Switzerland; email: edith.durisch@bd.zh.ch

Swiss running waters 2013: Updates to ecosystem protection, revitalization and quality management

Climate change and human activities will exert increasing pressure on freshwater ecosystems in the upcoming years. Freshwater ecosystems are habitats, which provide society with a diversity of socio-economic goods. This often leads to a loss of fundamental ecological requirements, reflecting the obvious resource–use conflicts. In Switzerland, one example is the planned phase-out of nuclear power, which needs to be partly offset by the expansion of hydropower operation, already accounting for around 55 % of the country's energy production. At the same time, strategies are developed to mitigate the adverse impacts of hydropower generation.

In the past years, Switzerland revised its environmental legislation. The Water Protection Act, which came into effect in 2011, calls for remedial measures to reduce the impacts of hydropeaking operations, reactivate sediment transport, and remove barriers to fish migration. The strategic goal is to restore about a quarter of the 15,000 kilometers of degraded river sections over the upcoming 80 years. To improve the sustainable management of water resources, several collaborations of the Federal Office for the Environment (FOEN, www.bafu.admin.ch) and the Swiss Federal Institute for Aquatic Research (Eawag) have developed two large programs: Swiss Running Waters ('Fliessgewässer Schweiz'), which includes restoration measures, a reduction of negative impacts from hydropower production, and biodiversity. The Follow-up Project Integral Watershed Management ('Integrales Flussgebietsmanagement') will start in 2013. The integral water management attempts to harmonize the use and protection of water, and the protection against the hazards of water (e.g., www.rivermanagement.ch) *(Fig. 1).*

Several projects are dedicated to those needs. One project at the River Spöl, attempts to integrate ecological and socio-economic interests into a sustainable watershed

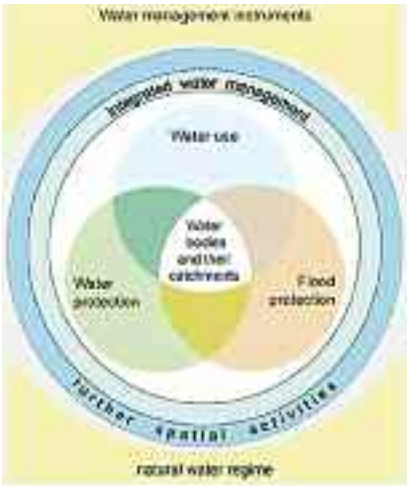


Figure 1. The scheme visualizes the major fields of watershed management in Switzerland. The figure was taken from FOEN (www.bafu.admin.ch).

management (Döring and Robinson 2012, Robinson and Uehlinger 2008). It is an excellent example, of how ecological and economic demands can be combined, as the water of artificial flood can be diverted to different basins to produce power by avoiding further costs. The project additionally implies that long-time monitoring is essential to properly evaluate the effects of specific measures. Another large pro-ject is dedicated to the transport of micropollutants (e.g., pesticides, hormonally active substances, and antibiotics) into river and ground water and their elimination from waste water (e.g. Götz et al. 2010). In 2013, Eawag started the pro-ject EcoImpact, which will examine swiss-wide the consequences of reducing the load of micro-pollutants from effluents of waste water treatment plants on river ecosystem functioning. Current activities provide a promising approach to identify obvious deficits and improve freshwater quality and ecosystem protection over the upcoming decades.

References

Döring M and Robinson CT (2012): Eawag news 72d, 18–21

Robinson C. and Uehlinger U (2008): Experimental floods cause ecosystem regime shift in a regulated river. Ecological Applications 18, 511–526

Götz C., Kase R, Kienle C, and Hollender J (2010): Mikroverunreinigungen aus kommunalem Abwasser – Kombination von Expositions- und öko-toxikologischen Effektdaten. GWA (actual Aqua & Gas) 7.

CR The Ukraine

Artem Lyashenko, Kateryna Zorina-Sakharova:* *Institute of Hydrobiology NAS of Ukraine, Kyiv, Ukraine; e-mail: artemlyashenko@bigmir.net; zsk@bigmir.net*

Investigations within the Ukrainian part of the Danube Delta

The Institute of Hydrobiology NAS of Ukraine (IHB) has launched systematic studies in the lower reach of the Danube as early as in 1945. Ukraine is one of IAD founder states. Since 1956, IHB is the official representative of Ukraine in this international organization. Several kind of international activities have been realized in line with international commitments of IHB relevant to the ecological problems of the Danube. IHB has organized international expeditions and IAD Conferences (1967, 1981, 1991). Numerous international research projects have been performed, the main among them of the latest years are:

Assessing the impact of environmental change on aquatic ecosystems in the Danube Delta (Swiss-UA-RO)

The study of the ecological characteristics of the water bodies of different type in two parts of the Danube Delta was one of the aims of the joint Romanian-Ukrainian research project sponsored by the Swiss SCOPES Foundation in 2006–2008. The main objectives were: realizing the first joint research study between Romanian and Ukrainian teams regarding Danube Delta aquatic ecosystems; assessing the ecological state of aquatic communities (plankton, benthic, macrophytes communities) from the representative types of aquatic ecosystems within both sides (Romanian and Ukrainian) of the Danube Delta Biosphere Reserve with an emphasis on freshwater lakes, channels and brackish lagoons; analyzing similarities and differences between the Danube Delta and the Kylia Delta aquatic ecosystems; estimating the ecological status of these ecosystems under the impact of the actual ecological stress due to nutrient inputs, river regulation and direct and indirect effects of global warming.

* IAD Country Representative of Ukraine

Development and application of diagnostic tools for identifying causes of environmental impairments in the estuarine systems of Ukraine (USA-UA)

This study focused on identifying contaminated areas and the clearest sites (i.e., reference or control) within Dnipro and Boh estuary and the Danube Delta using diagnostic approaches and tools developed by the U.S. EPA. The main objectives were: implementation of the complex triad (biotic, testing and chemical) assessment of bottom state; analyzing structural characteristics of benthic algae and invertebrates; evaluation of the ecological state of benthic communities; realization of bottom biotesting and estimation of toxicity level; implementation of complex biological and biotesting assessment of bottom state; identification of reference (the purest) and impaired (the most polluted) sites.

Joint environmental monitoring, assessment and exchange of information for integrated management of the Danube Delta region

This project was implemented by the International Commission for the Protection of the Danube River (ICPDR) in the framework of the "Environment and Security" initiative (ENVSEC) in cooperation with UNEP, UNECE and regional partners, including representatives of the three countries sharing the Danube Delta Sub-basin (Romania, Ukraine and Moldova), including a field study Joint Danube Delta Survey (JDDS).

References

Lyashenko A., Zorina-Sakharova K. (2008). Ecological characteristic of Danube Delta water body objects. National Committee of IAD Serbia and Montenegro. In: Proceedings 37th International Conference of IAD. Moldova 29.10.–1.11. 2008 / IAD, Chisinau. pp. 163–167.

Lyashenko A. V., Zorina-Sakharova Ye. Ye. (2009). Comparative Characteristics of the Indices of Invertebrates Macrofauna Diversity in the Ukrainian and Romanian Sections of the Danube River Delta. Hydrobiological Journal 45, 17–32

Romanenko V. D., Lyashenko A. V., Afanasyev S. A., Konovets I. M., Kipnis L. S., Zorina-Sakharova Ye. Ye., Terletskaya A. V., Milyukin M. V., Demchenko V. Ya., Burgess R. M., Ho K. T. (2011). Comprehensive Characteristics of Bottom Sediments of Water Bodies of Various Types in the Kyliya Delta of the Danube River. Hydrobiological Journal 47, 3–20

EGL Phytoplankton

Katrin Teubner: *University of Vienna, Austria; e-mail: Katrin.Teubner@univie.ac.at*

Studies on photosynthetic microorganisms in the Danube River meet the basic role of the primary producers for the ecosystem

Microbial primary producers play a key role in aquatic ecosystems and are hence of interest in Danube research for decades. The aspects studied on algae and cyanobacteria in the Danube River were as manifold as their multiple functions in the ecosystem. At the recent three conferences on Danube Research, in 2008, 2010 and 2012, about 33 percent of the studies on photosynthetic microbes referred to the composition of phytoplankton, i.e. the algae and cyanobacteria floating in the water channel *(Fig. 1).*

This research focus relates to detailed descriptions of species occurring in the various reaches of the Danube River, community descriptors as species richness and biodiversity among others.

Another 27 percent of the studies aimed at the role of phytoplankton for the ecosystem, i.e. measures of primary production, the interaction of phytoplankton with other organisms as bacteria and their role as a food source for zooplankton. The remaining studies were mainly linked to applied science issues. Bioassessment using phytoplankton and the response of these organisms to nutrient enrichment (eutrophication) and pollutants in the water related together to about 10 percent of the studies. Some studies did not refer to the Danube River, but to tributaries connected to the Danube River or wetlands.

A few studies dealt with benthic and epiphytic algae and cyanobacteria, living attached to macrophytes and shoreline material of the Danube River. The most rare phytoplankton studies were linked to the response to climate change and the potential toxin production by algae in the river. During all three IAD conferences, the contributions about phytoplankton community and their function in the Danube River ecosystem were most abundant, the other issues occurred sporadically.

No significant trends or changes in the Danube research focus could be recognized during this rather short period from 2008-2012.

References

37th IAD Conference Proceedings (2008): *The Danube River Basin* in a changing World. Chisinau, Moldova.

38th IAD Conference Proceedings (2010): Large River Basins – *Danube meets Elbe:* Challenges – Strategies – Solutions. Dresden, Deutschland.

39th IAD Conference Proceedings (2912): *Living Danube* – Szentendre, Hungary.

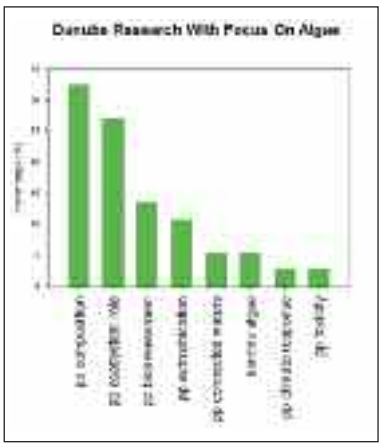


Figure 1. Danube research linked to photosynthetic microorganisms, i.e. algae and cyanobacteria in the river and connected water bodies. Eight of the nine research categories relate to phytoplankton (pp), only one to the attached living algae (benthic algae). This summary is based on the proceedings of the recent three IAD conferences in 2008, 2010 and 2012

EGL Floodplain Ecology

Ulrich Schwarz: Fluvius, Vienna, Austria; e-mail: ulrich.schwarz@fluvius.com

Floodplain conference at Neuburg a.d. Donau

In mid-October 2012 a floodplain conference took part again in Bavaria. Results were presented for already finished activities covering among others: a nation-wide balance study on floodplains and riparian areas and their ecological benchmarking for Germany, the Austrian inventory of floodplain areas and riparian forests, and several projects aimed at restoration of floodplains in Bavaria, which include the re-location of flood protection levees.

Other topics covered the methodology of assessing the ecological value of the hydro-morphological and biotic components in floodplain areas, as well as monitoring results of flood events.

The contributions were supplemented with presentations on floodplain management strategies and by proposals for campaigns in Austria and Bavaria, focusing on the promotion of a broader implementation of activities in the context of floodplain restoration.

References

The contributions of this conference can be downloaded at:
http://www.lfu.bayern.de/natur/auenprogramm/vortraege/index.htm

Figure 1. Participants of the Floodplain Conference held in Neuburg at the Danube (Bavaria, October 2012). Photograph: U. Schwarz

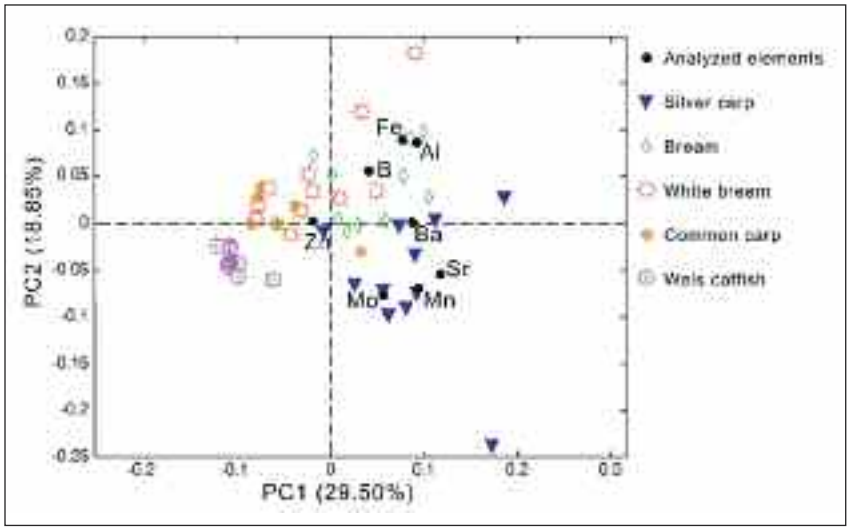


Figure 1. Principal Component Analysis applied on the elemental concentrations in gills of five studied fish species; the untreated data for elemental concentrations in gills were used as input variables. Silver carp was differentiated by higher concentrations of Mn, Mo and Sr, while catfish gills were characterized by the lowest concentrations of the analyzed elements (Lenhardt et al. 2012)

*Mirjana Lenhardt *, Željka Višnjić-Jeftić, Stefan Skorić, Ivan Jarić, Srđan Subotić, Milica Pucar, Aleksandar Hegediš: Institute for Multidisciplinary Research, Belgrade, Serbia; e-mails: lenhardt@imsi.rs; zvisnjic@imsi.rs; stefanskoric@imsi.rs; ijaric@imsi.rs; srdjan.subotic@yahoo.com; mpucar@imsi.rs; hegedis@imsi.rs*

Elemental profiles in gills, liver and muscle of different Danubian fish species as an indicator of the pollution status of freshwater ecosystems

Fish represent a good indicator of pollution. Differences among fish species regarding their habitat and food preferences could be a good indicator of the status of water and sediment pollution in a particular sector of large rivers. Methods such as inductively-coupled plasma optical spectrometry (ICP-OES) are suitable for a simultaneous investigation of a high number of elements, while chemometrics data analysis enables processing of such huge amounts of data. Research performed on 15 fish species caught in the Danube River at 1170 river kilometre revealed a significant differentiation among elemental concentrations in liver of piscivorous, planktivorous, omnivorous and benthophagous fish species, while concentrations of elements in gills were connected with fish habitat and behaviour *(Figure 1).* Piscivorous fish had higher concentrations of Hg in liver and muscle (Subotić et al. 2013). Detailed data analysis could support proper selection of fish species that would be referent indicator species for the pollution monitoring in a particular river section.

* EGL Fish Biology / Fishery

References

Lenhardt M, Jarić I, Višnjić-Jeftić Ž, Skorić S, Gačić Z, Pucar M, Hegediš A (2012): Concentrations of 17 elements in muscle, gills, liver and gonads of five economically important fish species from the Danube River. Knowl. Manag Aquat. Ec. 407, 1-10 (DOI: 10.1051/kmae/2012028)

Subotić S, Višnjić-Jeftić Ž, Spasić S, Hegediš A, Krpo-Ćetković J, Lenhardt M (2013): Distribution and accumulation of elements (As, Cu, Fe, Hg, Mn, and Zn) in tissues of fish species from different trophic levels in the Danube River at the confluence with the Sava River (Serbia). Environ. Sci. Pollut. R. (DOI 10.1007/s11356-013-1522-3)

EGL Saprobiology

Gunther Seitz: District Government of Lower Bavaria, 84023 Landshut, Germany; e-mail: gunther.seitz@reg-nb.bayern.de

Invasive alien species: a significant water management issue for the Danube River Basin
IAD members engaged in enhanced research activities for monitoring and assessment of invasive alien species in Danube River Basin

Problem statement

Alien Species or Neobiota refer to a species, subspecies or lower taxon, introduced outside its natural past or present distribution; it includes any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce. Invasive Alien Species (IAS) are non-native species whose introduction and/or spread outside their natural past or present ranges pose a risk to biological diversity. When these species are transported to ecosystems outside their established range, problems can be caused for native organisms, disturbing the balance of natural communities by altering the populations, the community structure, ecosystem structure and function. IAS have been recognised as the second most important threat to biodiversity at the global level (after direct habitat loss or destruction) and they represent a serious impediment to conservation and sustainable use of global, regional and local biodiversity. IAS have significant adverse impacts on so called ecosystem services. The disruption of these services as a result of biological invasions is known to have adverse socio-economic and cultural impacts (e.g. allergies and skin

damage caused by IAS). IAS can also reduce yields from agriculture, forestry and fisheries or obstruct transportation by blocking waterways. IAS are also known to decrease water availability and intake and cause land degradation. Certain invasions of alien species have also led to declines in recreational or cultural heritage values associated with different landscapes and water bodies. The economic costs and benefits associated with species introductions and biological invasions have attracted increasing attention during the past decade. It is of course acknowledged that non-native species can offer higher economic returns in some sectors, for example through plantations of fast-growing non-native conifers, satisfying demand for exotic products, pets and garden plants. However, a growing body of evidence suggests that IAS can have, and indeed have had, significant negative economic impacts that can also be measured in monetary terms. (Kettunen & al. 2009).

Parts of European inland waterways that are highly "biologically" contaminated are probably irreversibly changed with respect to their faunal composition. Numerous communities are now dominated by alien species. In some water bodies alien-dominated communities have shown very stable compositions of dominant species for more than a decade. The main European invasion corridors for the spread of aquatic species are the northern corridor, the central corridor, the southern corridor, the western corridor, the southern meridian corridor and the northern meridian corridor with estuaries of large European rivers serving as "invasion gateways" (Panov & al. 2009). Principal human activities involved in the spread of alien species are, aside from the construction of canals and the movements of ships, the wild fishery and aquaculture activities, ornamental and live food trade, leisure and biological control activities, research and education projects with releases of experimental organisms, hydromorphological alterations and others. Main negative ecological effects are competition, predation, hybridisation, toxicity, reservoir for parasites, disruption of pollination; alterations of energy and nutrient flow in food webs, changes of ecosystem composition and over all extinction of native species. An actual list of all 12122 alien species occurring in Europe is presented by DAISIE ("Delivering Alien Invasive Species Inventories for Europe", http://www.europe-aliens.org/ index.jsp) supported by EU research funds. As an essential tool for preventing their spread and impact, and for applying effective and appropriate control strategies 100 of the worst IAS are identified. Species accounts for these species provide information on their biology, ecology and distribution (including detailed maps), introduction pathways, invasion trends, impacts and management methods including ways of prevention. Further appropriate sources of information are http://www.issg.org and http:// www.nobanis.org and http://www.aquaticinvasions.net; the latter as an electronic open-access peer-reviewed international journal focusing on biological invasions in European inland and coastal waters, established in 2006 as an initiative of the European Research Network on Aquatic Invasive Species (ERNAIS).

Present situation in Danube River Basin

The Danube River is part of the "Southern Invasion Corridor", linking the Black Sea basin with the North Sea basin via the Danube-Main-Rhine waterway. After construction of the Main-Danube channel, the Danube became an important invasion route. An accelerated spread of non-indigenous species along the Danube in both directions and into its tributaries was recorded during the last two decades (Tittizer & al. 2000; Liška et al. 2008). Within the EC-ALARM project (Assessing Large Scale Environmental Risks for Biodiversity with tested Methods), the AISSIC data base (Aquatic Invasive Species of Southern Invasive Corridor) with 2,813 records including 141 alien and cryptogenic taxa has been established in the Institute for Biological Research, Belgrade. For a risk-based assessment of invasiveness of the alien species, the classification referring the European strategy on invasive alien species (Genovesi & Shine 2003) was used. All aliens are sorted into three categories: a white list of species for those which are harmless or might even be of use or benefit; a grey list for species whose category is unclear and for which information of the potential risks of rapid dispersal, establishment and adverse impacts is not available; a black list of species which are invasive and cause serious harm. The evaluation of any given species has to be based on transparent scientific criteria that are periodically reviewed. As to the Danube River Basin this harmonization is very important and urgent because the research activities indicate that it is under a high pressure of biological contamination and biological pollution. Consistent data on IAS in the different Danube countries are actually even scarce and not harmonized on a basin-wide scale. An appropri-

Figure 1. The invasive Ponto-Caspian crustacean amphipod Dikerogammaraus villosus, called 'Killer Shrimp'. With a size of about 2 cm and omnivorous predator feeding on a variety of macroinvertebrates, including other gammarid species, it exhibits an important biotic potential and ecological plasticity (Photograph: B. Eiseler)

ate monitoring program is to be established in order to provide sufficient data on IAS concerning new occurrence, distribution, changing of population size and registration of adverse effects on native taxa and their biotopes.

Perspective

Based on their leading position in several governmental and scientific institutions many IAD members are engaged in the monitoring and assessment process regarding alien species both in aquatic and terrestrial biocenoses. With their contributions of data sets from their countries the monitoring and assessment group of ICPDR is actually producing a guidance document with IAS related issues within Danube River basin, which includes data collection, development of assessment procedures and suggestions of the protection measures. In August 2013 the third Joint Danube Survey (JDS 3) will take place, an expedition by ship from Regensburg/Germany to the mouth of the Danube organized by ICPDR. Aims amongst others are getting more information about the distribution of IAS and their biological and ecological traits; participating IAD members will contribute to the success of this project. Finally IAD is waiting for the decision of BiodivERsA, a network of 21 research-funding agencies across 15 European countries, whether a three year research proposal referring IAS in the Danube River basin will be accepted. The goal of this project is to develop a common IAS risk assessment and prioritization as well as management tools which can be used in trans-boundary context and will contribute to the sustainable development in the Danube and Western Black Sea region.

References

Genovesi, P. & C. Shine (2003): European strategy on invasive alien species final version. Convention on the Conservation of European Wildlife and Natural Habitat. Council of Europe Strasbourg: T-PVS (2003) 7 revised. pp.1–50

Kettunen, M., Genovesi, P., Gollasch, S., Pagad, S., Starfinger, U. ten Brink, P. & Shine, C. (2009): Technical support to EU strategy on invasive species (IAS) - Assessment of the impacts of IAS in Europe and the EU (final module report for the European Commission). Institute for European Environmental Policy (IEEP), Brussels, Belgium. 44 pp. + Annexes

Liška, I., Wagner, F., Slobodnik, J. (Eds.) (2008): Joint Danube Survey 2 - Final Scientific Report. ICPDR – International Commission for the Protection of the Danube River, Vienna. 242pp.

Panov, V.E., Alexandrov, B., Arbaciauskas, K., Binimelis, R., Copp, G.H., Grabowski, M., Lucy, F., Leuven, R.S.E.W., Nehring, S., Paunović, M., Semenchenko, V., Son, M.O. (2009): Assessing the Risks of Aquatic Species Invasions via European Inland Waterways: From Concepts to Environmental Indicators. Integrated Environmental Assessment and Management 5, 110–126

Tittizer,T., Schöll, F., Banning, M., Haybach, A., Schleuter, M. (2000): Aquatische Neozoen im Makrozoobenthos der Binnenwasserstraßen Deutschlands. – Lauterbornia 39, 1–72, Dinkelscherben.

Risk assessment of benzotriazoles in surface waters

EGL Ecotoxicology

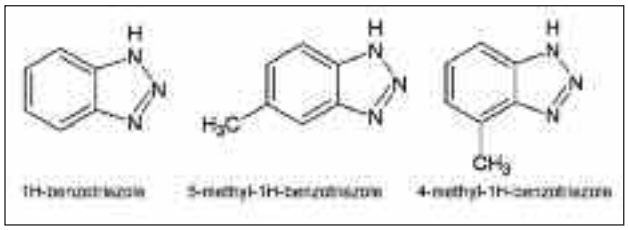
Willi Kopf, Klaus Weiß, Michaela Baumann: District Government of Lower Bavaria, 84023 Landshut, Germany; e-mail: gunther.seitz@reg-nb.bayern.de*

As components of corrosion inhibitor agents, dishwater detergents and aircraft deicing fluids benzotriazoles and tolyltriazoles enter into the aquatic environment via sewage treatment plants (Janna et al 2011; Loos et al 2009).

Ensuring good ecological status fails to include numerous micropollutants: when assessing ecotoxicological risk national environmental quality standards (EQS) are required

Previously published studies do not allow for any final ecotoxicological evaluation. Nevertheless, standardized ecotoxicological bioassays on these substances were carried out in compliance with the *'Technical guidance for deriving environmental quality standards'* (TGD-EQS 2011). PNEC (Predicted No Effect Concentrations) values were derived by means of acute and chronic toxicity, on green algae *(Desmodesmus subspicatus),* daphnids *(Daphnia magna)* and fish *(Danio rerio,* embryo). For benzotriazole, 4-methyl-1H-benzotriazole and 5-methyl-1H-benzotriazole a PNEC was calculated as 380, 140 and 150 µg/L, respectively *(Fig. 1).* Compared with reported aquatic concentrations, an ecotoxicological risk is not suggested (Baumann et al 2013). The IAD expert group ecotoxicology is proceeding in assessing further hazard substances in river water e.g. pharmaceuticals and their effect on non-target organisms.

Figure 1. Benzotriazoles relevant for ecotoxicological studies



References

TGD-EQS (2011): Technical guidance for deriving environmental quality standards. European communities technical report 2011–055

Loos, R., Gawlik, B. M., Locoro, G., Rimaviciute, E., Contini, S., Bidoglio, G. (2009): EU-wide survey of polar organic persistent pollutants in European river waters. Environ. Pollut. 157, 561–568

Janna, H., Scrimshaw, M. D., Williams, R. J., Churchley, J., Sumpter, J. P. (2011): From dishwasher to tap? Xenobiotic substances benzotriazole and tolyltriazole in the environment, Environ. Sci. Technol. 45, 3858–3864

Baumann, M., Weiß, K., Schüssler, W., Kopf, W. (2013): Ökotoxikologische Beurteilung von Benzotriazol, 4-Methyl-1H-Benzotriazol und 5-Methyl-1H-Benzotriazol für Binnengewässer. Vom Wasser, in press.0

* EGL Ecotoxicology

Thomas Hein: *WasserCluster Lunz & University of Natural Resources and Life Sciences, Vienna, Lunz, Austria; e-mail: Thomas.Hein@boku.ac.at*

As one example of various activities addressing fundamental ecosystem processes such as ecosystem metabolism and nutrient cycling, results from one particular research project with high relevance for floodplain restoration are presented here.

Results on the effect of changes in connectivity on nitrogen cycling in floodplains of the Danube River downstream Vienna

Current results of the PhD thesis of Nina Welti highlighted the importance of hydrological connectivity for nitrogen cycling in river floodplains. Her thesis was part of the FWF project CanFlood (financed by the FWF, project P19907-B17), which was led by Thomas Hein (PI), Gilles Pinay (Co-PI) and Helmut Habersack (Co-PI), in cooperation with Sophie Zechmeister-Boltenstern, Wolfgang Wanek und Fritz Schiemer.

She described her key findings as follows: Increasing pressure on rivers results in the decoupling of the naturally occurring floodplains, resulting in a loss of ecosystem services provided by these transition zones. Especially floodplains are seen as the ecosystem service centers of river ecosystems, acting as biogeochemical hot spots of nutrient cycling and key sites of nutrient transformation. Floodplains act as sinks, preventing river eutrophication and accumulating toxic compounds such as nitrite and heavy metals in their sediments. Efforts to restore floodplains by reconnecting them to their source rivers have primarily focused on re-establishing the unique habitats found in natural floodplains (i.e. fish spawning sites). However, the resulting biogeochemical changes are not well documented. The purpose of this study was to understand the effects of present large-scale changes in the biogeochemical cycling of two floodplain systems in the Danube River Basin. Nitrogen cycling was chosen due to the capacity of floodplains to remove nitrate from the river and to produce nitrous oxide, a harmful greenhouse gas.

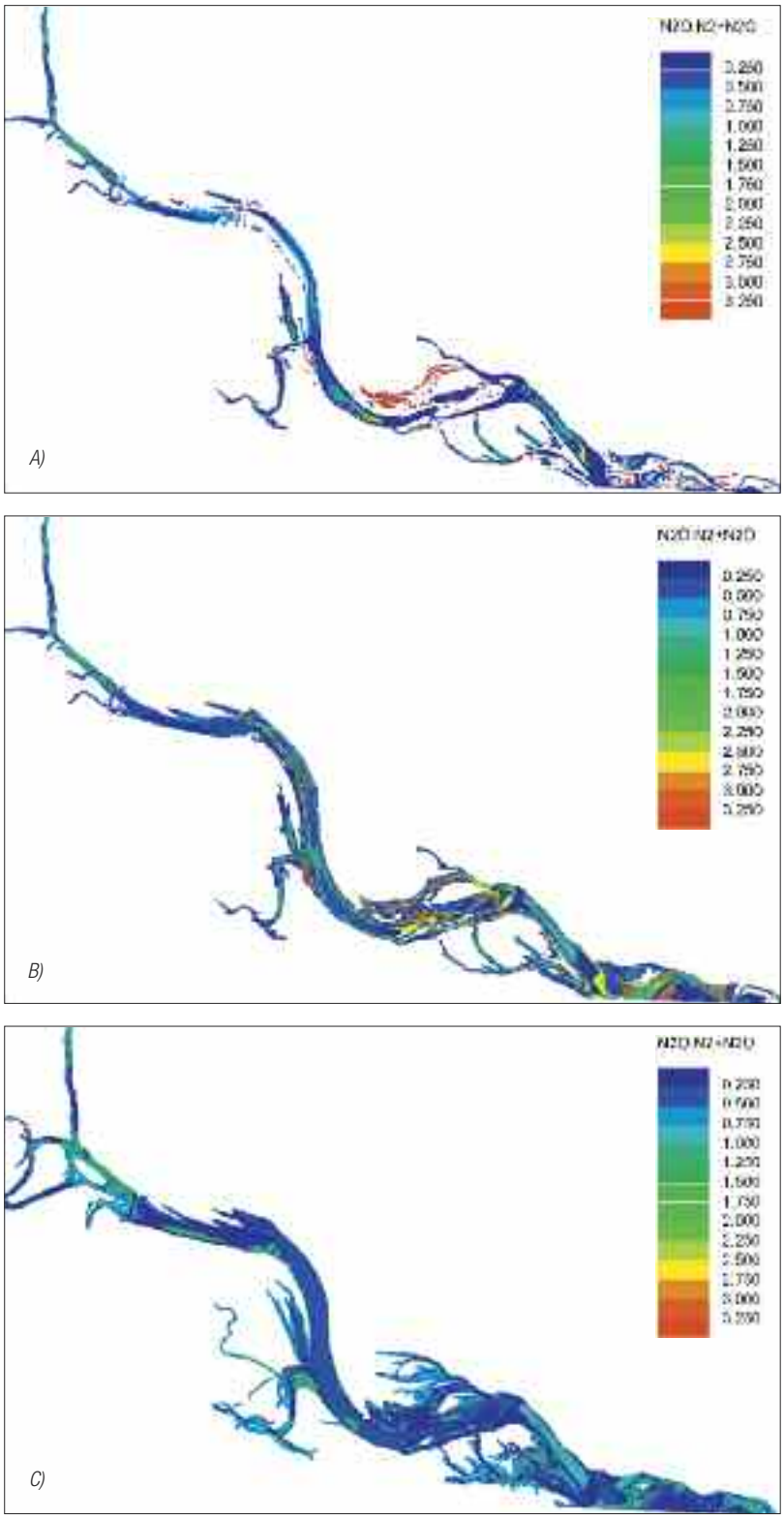


Figure 2. Ratios of N_2O:N_2 + N_2O as predicted by the integrated modeling tool for the Lobau floodplains. A) average discharge of 1900 m^3s^{-1}, B) elevated discharge of 3500 m^3s^{-1}, C) annual flood discharge of 5300 m^3s^{-1}. Colour Code: Red = high, Blue = low.

The most important finding of this project demonstrated how floodplain restoration alters the nitrate removal pathways and ultimately N_2O and N_2 emission. Nina Welti's research has shown that restoration, by increasing the frequency of inundation, improves biogeochemical cycling efficiency and reduces N_2O emissions from denitrification when compared with uncoupled floodplains. Restoration by increasing surface

water connectivity changes the abundance and diversity of the process facilitators, the microbial and phytobenthic communities, driving the biogeochemical processes. By altering the frequency, duration, period of occurrence, and variability of water levels, the water regime or surface water connectivity can directly affect nitrogen cycling in alluvial sediments and at the sediment – water interface by controlling the duration of oxic and anoxic phases and thereby altering nitrification and denitrification rates.

Generally, this project improved the understanding of the function of different subsystems within the floodplain landscape as well as the role of overall transformation capacity and biogeochemical interplay within floodplain systems. Using the produced modeling tool, patterns of high activity in areas which were frequently inundated by the Danube River were identified. A series of laboratory experiments elucidated the specific changes resulting in a reduction of N_2O production. Overall, this project fostered the understanding of nitrogen cycling in floodplains and supports restoration efforts which are more effective in transforming nutrients within the riverine landscape, which affects the nutrient transport at the catchment scale.

Figure 1. Typical floodplain water body in the Lower Lobau, dominated by reed vegetation. Photograph: N. Welti.

References

Tritthart M., Welti N., Bondar-Kunze E., Pinay G., Hein T. and Helmut Habersack (2011): Modelling highly variable environmental factors to assess potential microbial respiration in complex floodplain landscapes. Environmental modelling and software 26, 1097–1111.

Welti, N., Bondar-Kunze, E., Mair, M., Bonin, P., Wanek, W., Pinay, G., and Hein, T. (2012): Mimicking floodplain reconnection and disconnection using ^{15}N mesocosm incubations. Biogeosciences, 9, 4263-4278, DOI:10.5194/bg-9-4263-2012, 2012.

Welti, N., E. Bondar-Kunze, M. Tritthart, G. Pinay, and T. Hein. (2012): Nitrogen dynamics in complex river floodplain systems: effects of restoration. River Systems. DOI: 10.1127/1868-5749/2011/0047

Welti, Nina, Elisabeth Bondar-Kunze, Gabriel Singer, Michael Tritthart, Sophie Zechmeister-Boltenstern, Thomas Hein, und Gilles Pinay (2012): Large-scale controls on potential respiration and denitrification in riverine floodplains. Ecological Engineering 42, 73–84.

The Danube Sturgeon Task Force – a new hope for sturgeon conservation in the Danube River Basin

Cristina Sandu: *Institute of Biology, Romanian Academy of Sciences, Bucharest; e-mail: sanducri@yahoo.com*
Jürg Bloesch: *IAD, Stauffacherstrasse 159, Zürich, Switzerland; e-mail: Juerg.Bloesch@emeriti.eawag.ch*

The adoption of the Sturgeon Action Plan (SAP 2005), in the frame of the Bern Convention, aiming *to secure viable populations of all Danube sturgeon species and forms by sustainable management and by restoration of their natural habitats and migratory movements,* was a big step forward for sturgeon conservation in the Danube River Basin. However, in spite of the supportive measures taken by several Danube countries, the ICPDR, IAD and WWF, its overall implementation remained problematic, and the status of sturgeon populations is worsening (http://www.iucnredlist.org).

The EU Strategy and other international programs

The EU Strategy for the Danube Region (EUSDR), aiming to reunite all the sectorial policies concerning ecological connectivity, environmental protection, building economic prosperity and strengthening the region under one integrative vision for the Danube Basin, provided a new opportunity to foster the SAP implementation. In January 2012, with the support of the EUSDR Priority Area 6 (Biodiversity), the International Commission for the Protection of Danube River (ICPDR), the International Association for Danube Research (IAD), the WWF International (Danube Carpathian Programme) and some research institutes, the Danube Sturgeon Task Force (DSTF) was established. Its mission is to support the EUSDR target *"to secure viable populations of Danube sturgeon species and other indigenous fish species by 2020",* which is based on the SAP and following the successful "Salmon 2020" Program on the River Rhine.

Consequently, the DSTF has launched the **Program "Sturgeon 2020"**, whose strategy for implementation focuses on six major topics:

1. Acquiring political support
2. Administrative capacity building and law enforcement
3. Sturgeon in-situ conservation
4. Sturgeon ex-situ conservation
5. Socio-economic development
6. Raising public awareness

Figure 1. Iron Gates dam (1972), rkm 942. Hydropower plant constructions in the Danube and major tributaries disrupt migration routes and prevent sturgeons from reaching historical spawning grounds. Therefore, an in-situ feasibility study is planned to reopen both Iron Gates dams I and II with a technical construction for sturgeon passage. Ultimately, the life-cycle of sturgeons must be closed to enable natural reproduction. Photo: Jürg Bloesch

The success of the Program "Sturgeon 2020" depends on the long-term commitment and the implementation power of the Danube and Black Sea countries, as it requires complex cooperation between governments, decision makers, local communities, scientists, NGOs, private investors, etc. Key measures encompass habitat protection, restoration of migration routes, supportive stocking programs, economic alternatives to sturgeon fishery, fighting illegal fishing and the caviar black market, ecological education, harmonization of legislation and law enforcement.

The role of the DSTF will be to ensure overall coordination of the conservation measures by fostering the implementation of the Program "Sturgeon 2020", activating the synergies of existing organizations for project development, promoting inter-linkages with the relevant stakeholders and ensuring the horizontal connectivity with the other Priority Areas of the EUSDR. More information is available on www.dstf.eu.

References

Bloesch J, Jones T, Reinartz R, Striebel B (eds) (2005): Action Plan for the conservation of Sturgeons (Acipenseridae) in the Danube River Basin. Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention), *Nature and Environment 144, 122 pp.*

In memory of Dr Martin Schneider-Jacoby (1956–2012)

EuroNatur: *Radolfzell, Germany; e-mail: info@euronatur.org*

Dr Martin Schneider-Jacoby, who died at the age of 56 on 15 August 2012 following a brief illness, was a long-serving project manager with the EuroNatur foundation for nature conservation based in Radolfzell on Lake Constance. On hearing the sad news, a fellow campaigner wrote, "Really, we should all leave our offices now and go bird watching in Martin's memory." An enthusiasm for nature was the central theme to Schneider-Jacoby's life, and it was an integral part of his personality. Growing up in Schwäbisch Hall, he became interested in ornithology from an early age. Indeed, it was his father who introduced him to the world of birds, and by the age of fifteen, he had begun to do volunteer work protecting birds on the Wollmatinger Ried nature reserve on Lake Constance – something he kept up until his death.

Schneider-Jacoby's main role for almost half his life was as a project manager for EuroNatur, where he showed unstinting commitment, as he championed the preservation of Europe's natural heritage. His work to preserve and protect valuable dynamic river landscapes is particularly worthy of mention. He spent three years on the river Sava from

1986–1988 on a research project, studying the significance of birds as indicators for the conservation of wetlands. The results of these studies earned him his doctorate. During his years on the Sava Schneider-Jacoby immersed himself in the nature, culture and mentality of the people of this region to the southeast of Zagreb. The area became his second home – and he did not let anything sever that connection even in the later difficult days of the Yugoslavian wars. In that same period he also managed to lay the foundations for one of EuroNatur's first projects: the conservation of the unique natural and agricultural landscape along the Sava River. Today the name Schneider-Jacoby is inextricably linked to the Lonjsko Polje Nature Park, at the very heart of the Sava floodplains.

Figure 1. The death of Dr Martin Schneider-Jacoby means the loss to European nature conservation of one of its most committed campaigners. (Photograph © Gunther Willinger)

Conservation without frontiers

A large part of his professional life was dedicated to a quest for transboundary co-operation. As early as 2004, Schneider-Jacoby had made a valuable contribution to the Balkan strategy of the International Union for the Conservation of Nature (IUCN), and, from the very beginning he was a forceful proponent of the 'European Green Belt', one of Europe's most important nature conservation initiatives. When the Iron Curtain fell, he immediately began campaigning for the establishment of the Danube-Drava National Park on the border of Hungary and Croatia; today this nature reserve protects a very important section of the European Green Belt. Schneider-Jacoby's role as a pioneer is reflected in the black and white pictures taken in 1990. They show him standing alongside Hungarian conservationists on the bank of the river Drava on the Hungarian-Croatian border, campaigning for large-scale protection of this border area. In the mid-1990s Martin Schneider-Jacoby worked with conservationists from Hungary, Croatia, Slovenia, Austria and Serbia to develop a vision for a transboundary biosphere park to protect the important river landscapes of the Danube, Drava and Mura rivers. The area's natural treasures and extensive areas where, to this day, the agricultural landscape remains traditional provide this stretch of the Mura and Drava rivers leading to the Danube with the optimum conditions for this type of conservation area. The Mura-Drava-Danube Biosphere Reserve would be the first to extend across the borders of five countries and to be jointly managed – an example of regional co-operation, international understanding and a symbol of conciliation between countries along the former Iron Curtain who were once enemies. Schneider-Jacoby was able to hear the news that this vision is soon to become a reality: in June 2012 a significant milestone was reached when UNESCO voted to accept Croatia's and Hungary's application and recognized the lion's share of this wild river landscape as a biosphere reserve. "We and all our partner organizations feel duty bound to continue working on Martin Schneider-Jacoby's vision and bring it to a successful conclusion," says Gabriel Schwaderer, head of EuroNatur. In 2010 Schneider-Jacoby's work to protect the European Green Belt earned him the Binding Prize for Nature and Environmental Conservation.

Martin Schneider-Jacoby had wealth of experience amassed over the years, and not only the EuroNatur foundation but also an extensive network of conservation organizations right across Europe benefited from this. He was an exceptional conservationist and a very special person. "For us Martin Schneider-Jacoby will live on in the wild rivers in the Balkans, in the blue heart of Europe," says Christel Schroeder, EuroNatur's president.

Ecological aspects of viruses in a large river (Danube, Austria): a widely ignored field of inland water ecology

Peter Peduzzi: Department of Limnology, University of Vienna, Austria, e-mail: peter.peduzzi@univie.ac.at

Soon after the discovery of high numbers of viruses in aquatic environments, it was observed that bacterio- and phytoplankton may be significantly affected by viruses. We now know that viruses are ubiquitously distributed in aquatic environments, varying in abundance from $<104 ml^{-1}$ to $>108 ml^{-1}$ (Weinbauer 2004). Also in inland waters, viral abundance is generally one to two orders of magnitude higher than that of bacterioplankton (Peduzzi & Luef 2009).

For freshwaters, the role of biotic interactions between viruses and their cellular hosts is less well studied as compared to the marine environment, and many aspects are still not sufficiently investigated. Inland waters provide a high degree of spatial variability that apparently influences virus distribution strongly. Depth gradients are commonly observed

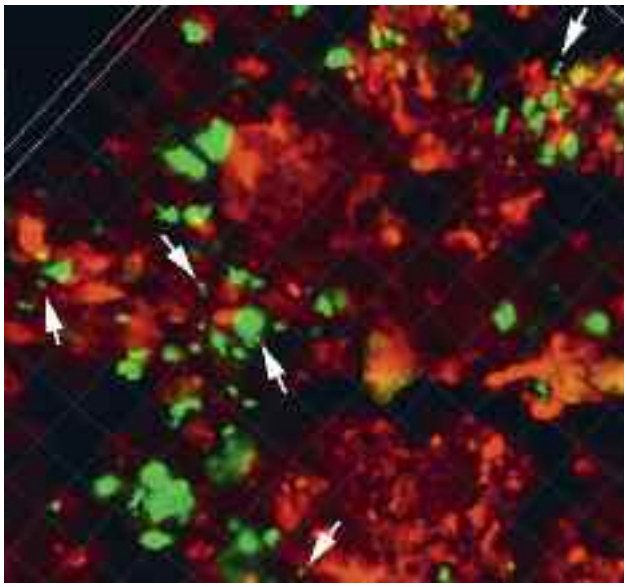


Figure 1. 3D volume reconstruction from a suspended river particle. Arrows point to nucleic acid signals from viruses. Color allocation: green nucleic acid (also from bacteria or cell nuclei); red, glycoconjugates (lectin-specific polymeric particle matrix). Calibration grid: 5 µm. Photograph: P. Peduzzi

in many water bodies; hence viral distribution follows vertical patterns similar to other planktonic organisms. Various kinds of discontinuities in the water column (e.g. thermoclines, pycnoclines, chemoclines, fronts) often lead to changes in viral abundance. Lateral discontinuities such as interlinked water bodies of a river-floodplain can also harbour varying virus numbers. Surprisingly, in river ecology many aspects of aquatic virus ecology are underrepresented or even largely ignored, i.e. ecological studies on viruses in running water ecosystems are strikingly scarce. Only a handful of Earth's running waters have been in the focus of virus ecology. However, in very recent time the interest and the perception among limnologists and microbial ecologists apparently is growing (Peduzzi & Luef 2009).

The potamal region of a pristine river (as the Danube in Austria before regulation) appears to have the highest connectivity with the surrounding landscape through a multitude of lateral interactions as well as the highest species richness and habitat diversity. Side arms, dead side arms, separated meander segments and expansive floodplains, as they naturally appear in this meandering reach of a river, create a broad range of lotic, lentic and semi-aquatic habitats. In most populated regions, these lower reaches of large rivers serve as transport routes, sources of hydroelectric power, dilution medium for waste etc. Almost all large rivers in Europe are greatly affected by pollution, alterations in the catchment, damming and regulation, some large rivers even being among the world's most degraded ecosystems.

Role of aquatic microorganisms in the food web

In most aquatic systems heterotrophic prokaryotes play an important role in the cycling of dissolved organic matter (DOM), thus consuming up to 50 % of primary production. The process by which bacterioplankton remineralize phytoplankton-derived DOM and convert part of it into prokaryotic biomass – thereby making it available to higher trophic levels such as heterotrophic nanoflagellates - is known as the "microbial loop" (Azam et al. 1983). In many aquatic systems this "loop" usually is also fuelled by macrophyte-derived and/or allochthonous organic matter (Peduzzi 2002). In all these environments, however, prokaryotic mortality caused by viral activity ultimately affects the cycling of DOM. Viral lysis transforms particulate organic matter into DOM and this material is available to bacterioplankton but not or minimally to flagellates. As a consequence, less organic matter is transferred to higher trophic levels. In model calculations for the marine environment, the additional DOM released by viral lysis boosts prokaryotic production by 33 % while heterotrophic nanoplankton production decreases by 20 %. In general, the importance of virus-induced mortality appears to increase with increasing prokaryotic abundance and/or productivity.

Virus particles in the Danube

Also rivers harbour a rich so-called "virioplankton", with numbers of up to 108 ml^{-1}, most of them being bacteriophages. Recent studies by our own working group compared different hydrological conditions in the Danube river-floodplain system near Vienna. This indicated that the abundance of viruses was highest under hydrologically isolated conditions, whereas lowest abundance was found in the main channel (Luef et al. 2007). Furthermore, we found that an occasionally significant proportion of the virus population (between 0.2–44 %) is associated with suspended seston material (Luef et al., 2007). The abundance of attached virus-like particles (VLPs) depended strongly on particle quality and composition. This prompted us to gain more detailed information on the abundance and distribution of VLPs associated with suspended particulate material. We developed a first ever method, using confocal laser scanning microscopy (CLSM), to resolve fluorescence signals of single viruses and bacterial cells in a complex three-dimensional matrix of riverine aggregates (Luef et al. 2009, Peduzzi & Luef 2009). Cryo-sections of the material allowed detecting the distribution of viruses, bacteria and polymeric constituents inside the aggregate with more accurate resolution in a reasonable time *(Fig.1).* Potential limitations of the CLSM technique due to scattering, laser penetration and diffusion of staining solutions can be overcome by analysis of cryo-sectioned post-stained samples. Aggregates from the Danube River harboured up to 5.39×10^9 viruses cm^{-3}. Thus, CLSM in combination with different fluorochromes revealed as a very promising approach for obtaining information both on aggregate architecture and on the spatial distribution of viruses attached to fully hydrated aggregates (Peduzzi et al. 2012). It is likely that aggregates represent hot spots for viral infection of bacteria. Bacterial lysis mediated by viruses on aggregates may be an important nutrient release mechanism of dissolved organic matter for bacteria in the surrounding water column. Furthermore, increased viral production onaggregates may also lead to

increased virus release into the water, which alters the distribution of viruses in the whole system.

Findings from laboratory experiments with Danube water revealed that the abundance of planktonic viruses had a negative, that of attached viruses a positive effect on bacterial productivity in the ambient water. Further, the average abundance of bacteria and viruses was significantly higher on organic than on inorganic particles and also higher on aged particles (both sediment and leaf litter). Thus, concluding from these experiments, both seston quality as well as variable viral abundances in the bulk water did impact overall microbial parameters (Kernegger et al. 2009).

Hydrological connectivity between the Danube River and its floodplain is crucial, not only for the exchange of water, sediment and nutrients, but also for microbiota, thus influencing microbial life, distribution and activity. Our investigations support the hypothesis that water age influences biological mechanisms that regulate bacterial and viral abundance, bacterioplankton productivity in the water column, and bacterial parameters on particles. Based on these results, increasing connectivity between the main channel and the floodplain significantly influences the abiotic and microbiotic processes in the floodplain segments and probably also in the river itself. A dynamic exchange allows the river to benefit from the floodplain production under connected conditions. The exchange of water likely also influences viruses. However, for many aquatic ecosystems, little is known on virus – aggregate interactions. For example, river systems are strongly impacted by climate and changes in river morphology, which are likely to trigger alterations in the flow regime and aggregate load or quality (compare Weinbauer et al. 2009). Thus, the potential impact on horizontal transport of particle-associated viruses deserves more and extensive investigations.

Virus diversity

A first screening of the virus community in the Danube river-floodplain system, using pulsed field gel electrophoresis (PFGE), revealed that various habitats (main channel, isolated pool at Lobau, dynamically connected section at Regelsbrunn) were apparently inhabited by distinct viral communities showing characteristic dynamics of viral diversity. The genome size for bacteriophages lies generally between 17 to 590 kb but mostly within the range from 30 to 60 kb. Overall, the genome sizes in our study were between 9 and 48.5 kb, thus within the range reported from other environments (Wommack & Colwell 2000). In the Danube river-floodplain system the virioplankton communities varied with respect to location and time. To better compare our findings with other studies we determined 7 genome size classes: <23 kb, 23–48.5 kb, 48.5–97 kb, 97–145.5kb, 145.5–194 kb, 194–242.5 kb and >242.5 kb. Although similar genome size classes could be found at all three sites, their variations and frequencies were different. Variability in virioplankton communities could be explained to 31% with the size classes 97–145.5 kb and 194–242.5 kb (as revealed by principle component analysis; PCA). These two size classes appeared only together in the two backwater systems, whereas in the main river each of them occurred at times when the other was not present. For genome sizes between 23 and 48.5 kb and between 145.5 and 194 kb, viruses of each of the two size classes were abundant when the other was low in frequency. The development of virioplankton communities also reflected the particular hydrological situation during the year of sampling (extraordinary low water table in 2003). While the community structure of the river and the dynamically connected floodplain section in Regelsbrunn (which was connected just prior to our sampling period) started with similar profiles dominated by viruses of genome sizes up to 200 kb, the pattern in this floodplain section diverged from the river over the time when experiencing no further introduction of water from the main channel. The all-time isolated section at Lobau showed a different development with rather stable virus populations and the presence of genome sizes >200 kb for all sampling dates and >242.5 kb until June. Viruses with genome sizes >200 kb are often referred to represent algal viruses. In the backwater systems viruses of this size range were present over the whole sampling period.

We observed a total of 55 different bands for all three sites during the sampling period. The number of bands on a PFGE fingerprint likely resembles the number of different viruses in a sample. It has to be considered, however, that more than one virus type can have the same genome size and thus, the number of bands obtained from a given sample is likely to be an underestimation of the different virus types that can occur: We therefore use rather the term apparent richness (S). Generally, S was higher in the two floodplain-sections with highest values in Lobau, which was significantly different from the main river station (ANOVA, $p < 0.01$; *Fig. 2).* In the river, values ranged between 5 and 8 with a single peak of 15. At Lobau S ranged from 12 to 17, increasing from mid March to

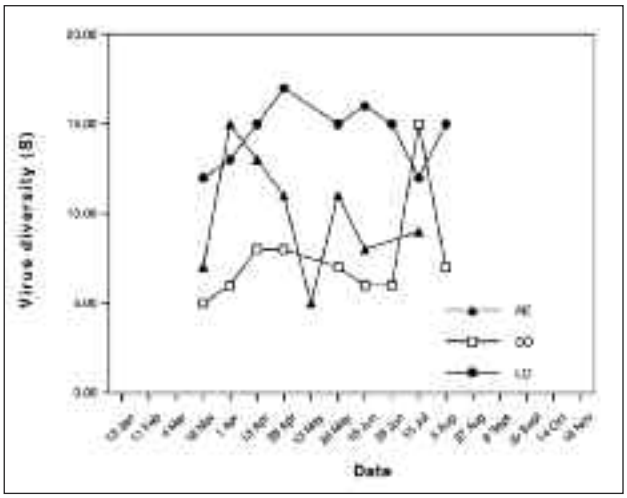


Figure 2. Variations of apparent richness (S) of viruses (based on pulsed field gel electrophoresis of genome sizes) in the Danube main river channel (DO), Lobau backwaters (LO) and the restored dynamic section Regelsbrunn (RE) during the hydrological variable phase, March to August, 2003.

the end of April and decreasing from the end of May to the end of July down to the initial value of 12. At the end of the sampling period it increased again in mid August. Large fluctuations were observed in Regelsbrunn: S ranged from 5 to 15 with a strong increase from mid March ($S = 7$) to begin of April ($S = 15$). Afterwards, there was a continuous decrease until mid of May ($S = 5$) and fluctuations until the end of the sampling period. Apparent richness in the main channel decreased with increasing gauge ($r = 0.72$, $p < 0.05$), while at Lobau it correlated with total bacterial production ($r = 0.71$, $p < 0.05$), indicating a link between bacteriophages and host activity. No correlation with either gauge or bacterial production could be observed for S in Regelsbrunn.

Conclusion

Virus ecology of flowing waters seems still to be in its infancy (compare Jacquet et al. 2010). Rivers and their floodplains are particularly interesting since pronounced environmental heterogeneity implies differences in virus-related processes on a narrow spatial and temporal scale. Moreover, river systems are often particle-rich environments, thus exhibiting heterogeneity even on very small spatial scales. It may be of particular interest investigating whether disturbances by flooding influences viral-induced mortality of prokaryotes, or whether viral lysis contributes significantly to a pool of rapidly cycling carbon in an environment with typically high proportions of aged and recalcitrant carbon. So far, almost nothing is known about the significance of viral activity on the carbon cycle in riverine systems. Finally, considering all types of inland waters (lakes, rivers, wetlands), more information on viral dynamics should substantially contribute to develop an amended understanding and a better management of freshwater resources.

References

Azam F, Fenchel T, Field JG, Gray JS, Meyer-Reil LA, Thingstad F (1983): The ecological role of water-column microbes in the sea. Mar Ecol Prog Ser 10, 257–263

Jacquet S, Miki T, Noble R, Peduzzi P, Wilhelm S (2010): Viruses in aquatic ecosystems: important advancements of the last 20 years and promising prospects in the field of microbial oceanography and limnology. Adv Oceanogr Limnol 1, 71–101

Kernegger L, Zweimüller I, Peduzzi P (2009): Effects of suspended matter quality and virus abundance on microbial parameters: experimental evidence from a large European river. Aquat Microb Ecol 57, 161–173

Luef B, Aspetsberger F, Hein T, Huber F, Peduzzi P (2007): Impact of hydrology on free living and particle-associated microorganisms in a river floodplain system (Danube, Austria). Freshw Biol 52, 1043–1057

Luef B, Neu TR, Peduzzi P (2009): Imaging and quantifying virus fluorescence signals on aquatic aggregates: a new method and its implication for aquatic microbial ecology. FEMS Microbiol Ecol 68, 372–380

Peduzzi P (2002): Significance of nonliving organic matter for microbial life in coastal aquatic systems. In: The Vienna School of Marine Biology: A Tribute to Jörg Ott; Facultas Universitätsverlag, Wien. pp. 121–135

Peduzzi P, Luef B (2009): Viruses. In G.E. Likens (ed.): Encyclopedia of Inland Waters. Vol. 3; Elsevier (Oxford). pp. 279–294

Peduzzi P, Agis M, Luef B (2012): Evaluation of confocal laser scanning microscopy for enumeration of virus-like particles in aquatic systems. Environ Monit Assess DOI: 10.1007/s10661-012-2955-8

Weinbauer MG (2004): Ecology of prokaryotic viruses. FEMS Microbiology Ecology 28, 127–182

Weinbauer MG, Bettarel I, Cattaneo R, Luef B, Maier C, Motegi C, Peduzzi P, Mari X (2009): Viral ecology of organic and inorganic particles in aquatic systems: avenues for further research. Aquat Microb Ecol 57, 321–341

Wommack KE, Colwell RR (2000): Virioplankon: viruses in aquatic ecosystem. Microbiology and Molecular Biology Reviews 64, 69–114

The Sterlet

Thomas Friedrich: Institute for Hydrobiology and Aquatic Ecosystem Management, BOKU, Vienna, Austria; e-mail: thomas.friedrich@boku.ac.at

The Upper Danube`s last 'Dinosaur'

Sturgeons are an ancient fish family, dating back over 200 Million years. They are characterized by very long life cycles, late maturation and can reach impressive sizes. The Sterlet (Acipenser ruthenus) is the smallest of the six Danube sturgeon species. As a pure freshwater species it inhabits the Danube and its tributaries and other rivers in the Ponto-Caspian region and undertakes spawning migrations of up to 300 km.

In the past sterlet could be encountered in the Danube from the Delta upstream to Ulm. Through habitat loss, overfishing and damming its stocks decreased in the last centuries. In the Upper Danube fragmentation of the habitat as a consequence of the construction of power stations can be seen as major reason for the extinction of sterlet in many river sections. For example catches of sub-adult specimens in the 1980s near Klosterneuburg, just upstream of Vienna, stopped after the construction of the power station Freudenau, as migrating specimens from downstream obviously could not reach their spawning grounds anymore. Today the Upper Danube`s last remaining Sterlet population resides in the hydropower impoundment Aschach, downstream of the power station Jochenstein. Adults and sub-adults are regularly caught, although no juveniles have been encountered to this point and the size of the adult population is

Figure 1. Sterlet (Acipenser ruthenus). Photograph: Clemens Ratschan

estimated to be rather low and to consist at best of only a few hundred individuals.

As a result of the small population size and the restricted habitat even minor negative impacts pose a massive threat to this population. The catch of hybrids between the Sterlet and the allochthonous Siberian sturgeon (Acipenser baerii) in the area indicated the high risk for native stocks and their genetic integrity posed by alien sturgeon species released into the wild. Until now, little is known about the characteristics of the key habitats, the habitat use, the migration patterns and the life cycle of sterlet within the Danube River, hindering effective in-situ conservation measures. Therefore a project was established to investigate the habitat and the size of the Jochenstein population in order to protect and sustain this rare fish. This task becomes even more important considering the various, to this point unsuccessful attempts to stock and re-establish sterlet in other sections of the Upper Danube, which most likely failed due to the lack of adequate habitats.

The Sterlet, next to the other sturgeon species, can be seen as a symbol and a flagship of the Danube and the many human pressures on this ecosystem. Therefore it needs our full attention!

News and Notes

Thomas Hein: Boku, Vienna; e-mail: thomas.hein@boku.ac.at

Modelling macrophyte development and the hydrology and morphology of floodplain waters

Iris Baart successfully finished her PhD research with the title "Historical and potential development of macrophytes in the Lobau due to hydrological and morphological conditions" at the University of Natural Resources and Life Sciences, Vienna (BOKU Vienna) on March 15th 2013. Her PhD research was performed in the working group of Thomas Hein at the BOKU, Vienna and at the WasserCluster Lunz. The thesis addresses the value of historical data of macrophytes and hydromorphological conditions of a Danube floodplain for current management plans and presents a modelling approach to predict macrophyte development affected by hydromorphological changes in the urban floodplain Lobau in the city of Vienna.

Major parts of this PhD thesis have been published in two papers (see References).

References

Baart, I. Hohensinner, S., Zsuffa I., Hein T. Supporting analysis of floodplain restoration options by historical analysis, Environ. Sci. Policy (2012): (http://dx.doi.org/10.1016/j.envsci.2012.10.003)

Baart, I; Gschopf, C; Blaschke, AP; Preiner, S; Hein, T. (2010): Prediction of potential macrophyte development in response to restoration measures in an urban riverine wetland. AQUAT. BOT. 93, 153–162

Photograph: Baart

ISSN 2070-1292

danube news

donau aktuell

Bulletin of the International Association for Danube Research (IAD)
Informationsblatt der Internationalen Arbeitsgemeinschaft Donauforschung (IAD)

International Association for Danube Research (IAD)

Presidium

President	Vice-President	General Secretary
Dr. Thomas HEIN	Dr. Ivana TEODOROVIC	Dr. Harald KUTZENBERGER

Member Country Representatives

D	CH	A	CZ	SK	H	HR
Dr. Fritz KOHMANN	Dr. Edith DURISCH-KAISER	Prof. Dr. Georg JANAUER	Dr. Jan HELESIC	Dr. Milan LEHOTSKY	Prof. Dr. Arpàd BERCZIK	Dr. Melita MIHALJEVIC

SLO	BiH	SRB	RO	BG	MD	UA
N.N.	N.N.	Dr. Snezana RADULOVIC	Prof. Dr. Marian Trajan GOMOIU	Dr. Roumen KALCHEV	Dr. Dumitru DRUMEA	Dr. Artem LYASHENKO

Expert Groups

Chemistry/Physics	Biotic processes	Microbiology / Hygienics	Phytoplankton / Phytobenthos	Macrophytes	Floodplain-ecology
Dr. Cristina SANDU	Dr. Thomas HEIN	Dr. Gerhard KAVKA	Dr. Katrin TEUBNER	Prof. Dr. Georg JANAUER	Dr. Ulrich SCHWARZ

Zoobenthos	Fish Biology / Fishery	Saprobiology	Ecotoxicology	Delta / Fore-Delta	Sustainable Development & Public Participation
N.N.	Dr. Mirjana LENHARDT	Dr. Gunther SEITZ	Dipl.-Biol. Willi KOPF	Dr. Julian NICHERSU	Dr. Harald KUTZENBERGER

Hydrological catchment of the River Danube

Address / General Secretary:

International Association for Danube Research (IAD)
(Internationale Arbeitsgemeinschaft Donauforschung)
Am Zunderfeld 12, A-4073 Wilhering
Tel.: 0043 727478881 Fax: 0043 727478884
E-mail: kutzenberger@iad.gs

IAD-Homepage: http://www.iad.gs

Editor:

Dr. Georg Janauer
Universität Wien
Department für Limnologie
Althanstraße 14, A – 1090 Wien
E-mail: georg.janauer@univie.ac.at

Layout:
Diener-Grafics GmbH
Winterthurerstr. 58, 8006 Zürich
Tel. 0041 (0)44 440 11 50

Printing:
VDV Friedrich, A-4020 Linz, Austria