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Editorial

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Danube-sidearm in the Austrian nationalpark, © Christian Baumgartner

Dear Readers,

An eventful Danube-year will end soon. On June 29th, the annual celebration of the Danube Day took place under the coordination of ICPDR, having as theme a "Cleaner Danube". The Danube Transnational Program, the first large European funding programme explicitly dedicated to the Danube River Basin, has provided funds to 54 projects, six of them being directly relevant for water management, flood risk prevention, environmental risk management and restoration and management of ecological corridors. In October the 6th Annual Forum of the European Union Strategy for the Danube Region was organized in Budapest, highlighting the need for developing connectivity and sustainable energy.

IAD is keeping up with the major challenges of the Danube Region by launching new projects and adjusting its organisational structure. The expert group on Chemistry/ Physics was reframed towards Water Quality thereby better reflecting the actual focus of the last years. Prof. Carmen Postolache from the University of Bucharest was elected as the new leader of this expert group, while for the Microbiology EG the new leader will be Prof. Alexander Kirschner, Medical University of Vienna. A new expert group on invasive alien species was established, led by Dr. Teodora Trichkova, the founder of the ESENIAS and DIAS networks. During its meeting in May, the IAD Board agreed also on establishing in the near future ad-hoc expert groups on climate change, hydromorphology and environmental education.

A plethora of national, bilateral and transnational projects is ongoing in the region or has been recently completed. Three of such projects are presented in this issue of DanubeNews. Paul Meulenbroek, Silke Drexler and Herwig Waidbacher describe a study of fish larvae dispersal and the availability of spawning grounds in different man-made habitat types of the Austrian Danube in Vienna and adjacent sections. The authors show that riprap sections, gravel bars and habitats in a sidearm and in the fish-by-pass system of the Viennese Danube hydropower plant Freudenau are used as spawning grounds and/or as habitats for juveniles, albeit the species composition differs. Among 31 species, 16 have been found which are considered endangered in the Austrian Danube. Larvae of invasive species dominated especially the riprap sections but also the by-pass system. Martin Burkhart and his colleagues from the State Office for Water in Ingolstadt, Bavaria present river restoration measures, which were implemented in the Bavarian Danube between Vohburg and Neustadt. Ecological improvement of bank structures to enhance the connectivity between the river, the riparian zone and the floodplains started 10 years ago. The different measures aimed also at a better accessibility of the riverbanks for the public and are in accordance with the management plan as defined against the background of the EU Water Framework Directive. Georgeta Stoica addresses an important topic, which links fish ecological targets, nature conservation and local fisheries management. During her PhD in anthropology, she studied knowledge and practices of local fishermen communities and their perception of nature conservation policies in the Danube Delta. Her article calls for interdisciplinary cooperation of natural, economic and social sciences and for learning from the experience of local communities, to bring forward fisheries management and policies, which are broadly accepted and agreed. A brief announcement of a new film of Oana Ivan about fishermen and their life in the Danube Delta in the News and Notes section further emphasizes the importance of the topic. Brief notes on a EU-LIFE project in the German Danube, on a new network for students´ and university teachers´ mobility as well as a new Interdisciplinary Doctoral program on Human River-Systems complete the issue.

Shoreline configuration determines species-specific fish larvae drift in the man-made River Danube

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Introduction

Navigation, flood protection and hydroelectric power generation as well as the disconnection of tributaries resulted in riverine habitat degradation and fragmentation. Numerous studies have pinpointed the ecological deterioration for certain faunal associations at the Danube and one of the important groups affected are riverine fish assemblages. Fish communities are good indicators for habitat structure as well as for the ecological integrity of river systems due to their complex habitat requirements at different stages of their life cycles. Especially functional spawning grounds and nursery habitats are considered to be limiting factors for riverine fish populations in the Danube nowadays.

Centuries of channelization, followed not least with regard to the Water Framework Directive by single restauration measures, resulted in a nearly complete man-made shoreline for the upper sections of the Danube. The present article summarises the results for the early life stages of fish deriving from the latest monitoring campaigns in Austria (2013-2015), where species-specific fish larval dispersal of three different constructed shoreline configurations (gravel bar, riparian side arms and riprap) and a near natural bypass system were investigated. The results of fish larval dispersal give an indication for the quality and acceptance of these artificial habitats as spawning grounds. More detailed results can be found in Waidbacher et al. (2016), Meulenbroek et al. (2017a), Meulenbroek et al. (2017b) and Waidbacher et al. (in press).

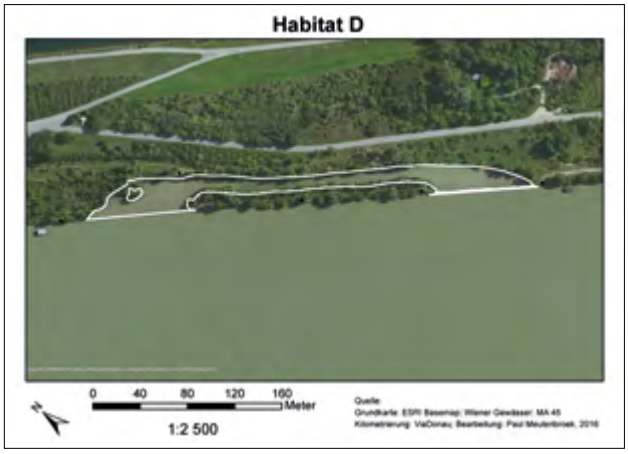

Figure 1. *One of the man-made side arms (Waidbacher et al. (2016))*

Figure 2. *Gravel-bank inshore structure under construction with two ripraps. Nowadays, after filling of the impoundment, only parts of the upper riprap are visible (Waidbacher).*

Methods and study site

The studies were conducted in Vienna between the hydropower plant (hpp) Freudenau and the hpp Greifenstein. In total, 12 sites were sampled. These include four riprap sections, as they are found at most of the Danubian shoreline nowadays and various mitigation measures, which were implemented 20 years ago at the impoundment of the newest hpp Freudenau/Vienna to counteract and minimize the impacts. The latter include three gravel bars, two artificially built side arms and three sites within a near natural fish bypass system. All sites are anthropogenically built or initiated.

The two sampled side arms *(Figure 1)* are man-made inshore structures at an orographic left-side bar of the Danube on the so called “Danube Island” in Vienna, with a length of 1.1 km (Habitat C) and 0.4 km (Habitat D).

All three gravel bars are also completely technically constructed. The riparian shoreline is fixed with a riprap, while another underwater riprap prevents the gravel bar from major dislocation into the main channel *(Figure 2)*. The uppermost gravel bar was initiated by setting up of a groin field.

The fish migration bypass system *(Figure 3)* has been constructed with two major components; a near natural bypass channel and a near natural pool pass. The bypass channel with a mean discharge of 1.6 m³/s and an average slope of 0.7 % is situated in a riverbed of seven meters width and a corresponding average current speed of around 0.6 m/s. It consists of a delta system in the tail water, a straightened section, followed by a 300 meters meandering section and a branched situation in the middle. The uppermost part of the system is built as a near natural pool pass with 19 pools.

Figure 3. Near natural fish bypass system Freudenau (Waidbacher)

Two of the studied riprap sections *(Figure 4)* are located in the central impoundment upstream of the side arms; another two in the uppermost part of the impoundment in a nearly free flowing section.

Early life stages of fish were sampled continuously from April to July 2013–2015 with drift nets. Subsequently a subsample of the trapped fish larvae was analyzed with mtDNA barcoding to species level (Meulenbroek et al. 2017a).

Results and Discussion

We collected more than 20.000 fish larvae, representing 31 species out of eight families. These include 13 species that are considered as endangered *(Aspius aspius, Ballerus sapa, Cottus gobio, Barbus barbus, Chondrostoma nasus, Esox lucius, Proterorhinus marmoratus, Rhodeus amarus, Leuciscus sp.)* and further three species *(Cyprinus carpio, Rutilus virgo, Zingel streber)* as in danger of extinction for the Austrian Danube. On a European scale, seven species *(Aspius aspius, Cottus gobio, Rhodeus amarus, Romanogobio vladykovi, Rutilus virgo, Gymnocephalus schraetser, Zingel streber)* are listed in Annex II of the Flora-Fauna-Habitat Directive. Table 1 shows the calculated relative distribution of all caught species and families separated for all sampling sites.

Figure 4. Riprap as it is found at most of the Danubian shoreline

Species of the Gobiidae family invasive in the upper Danube made up nearly half of the catches – and here most frequently Round Goby *(Neogobius melanostomus:* 32 %) and Bighead Goby *(Ponticola kessleri:* 12 %). Furthermore, the native Bullhead *(Cottus gobio:* 16 %) was frequently caught, followed by Asp *(Aspius aspius)*, Nase *(Chondrostoma nasus)* and Barbel *(Barbus barbus)* (all ~5.5%). Within the Percidae, Perch *(Perca fluviatilis)* and Pike Perch *(Sander lucioperca)* were most abundant. All other species were rare, with less than 3 %.

Regarding the spatial distribution and family/species composition, the results present a clear picture *(Figure 5):* Sites downstream of gravel bars are dominated by Cyprinidae (61–65 %) and equal shares of Percidae (13–18 %), Gobiidae (11–17 %) and Cottidae (8–13 %). Early life stages of fish caught in the side arms display a similar family distribution. By comparing on species level or functional spawning guilds the differences become apparent. While gravel banks provide spawning habitats for lithophilic species like *Chondrostoma nasus* or *Barbus barbus,* the side arm provides high proportions of organic material and macrophytes available for phytophilic species such as *Perca fluviatilis* or *Rutilus rutilus.*

In contrast, at riprap sections the majority of the caught larvae consist of speleophilic Gobiidae (47–53 %) and Cottidae (23–29 %). Cyprinidae (13–20 %) and Percidae (7–13 %) are less frequent in catches. The dominance of this shoreline configuration at the Danube accelerated the expansion of neobiota like Gobiidae by providing spawning grounds and suitable habitats. These results are in line with former studies, which conclude that near-natural shores provide substantially more suitable larval habitats for the native fish fauna than stabilized ones. Therefore, a measure to reduce the abundances of the invasive Gobiidae is to remove riprap where it is possible. Furthermore, these structural alterations affect the hydraulics of the inshore areas, which may have dramatic effects on the dispersal and viability of native fish populations (Meulenbroek et al. 2017a).

	Rip rap	Gravel bank	Side arm	Fish bypass
Cottidae	**24.43**	**8.47**	**1.06**	
Cottus gobio	24.43	8.47	1.06	
Cyprinidae	**17.31**	**64.05**	**70.95**	**25.90**
Abramis brama	0.10	3.84	6.20	
Alburnus alburnus		1.19	1.06	0.85
Aspius aspius	5.50	10.43	7.43	1.85
Ballerus sapa				0.03
Barbus barbus	1.78	15.45	1.06	11.47
Blicca bjoerkna		1.04		
Chondrostoma nasus	4.53	20.80	1.06	5.28
Cyprinus carpio		1.04	12.40	
Leuciscus idus	1.46	2.38		0.37
Leuciscius leuciscius				0.17
Pseudorasbora parva		1.19		
Rhodeus amarus	0.17			0.69
Romanogobio vladykovi				0.13
Rutilus rutilus	3.26	6.69	38.54	1.36
Rutilus virgo	0.33		2.12	0.05
Squalius cephalus	0.17		1.06	3.66
Esocidae			**0.58**	
Esox lucius			0.58	
Gasterosteidae	**0.14**		**1.06**	
Gasterosteus aculeatus	0.14		1.06	
Gobiidae	**50.66**	**13.37**	**6.98**	**53.72**
Babka gymnotrachelus	5.68			0.91
Neogobius melanostomus	33.76	11.51		37.74
Ponticola kessleri	11.22	1.86	6.98	14.85
Proterorhinus marmoratus				0.22
Percidae	**7.11**	**14.11**	**19.37**	**4.33**
Gymnocephalus cernua	0.02			0.99
Gymnocephalus schraetser	0.02			
Perca fluviatilis	1.49	2.82	4.77	0.78
Sander lucioperca	4.51	6.37	14.60	1.52
Sander volgensis	0.30			
Zingel streber	0.16	0.93		
Zingel zingel	0.62	3.99		1.04
Salmonidae	**0.34**			
Coregonus sp	0.34			
Siluridae				**16.04**
Silurus glanis				16.04

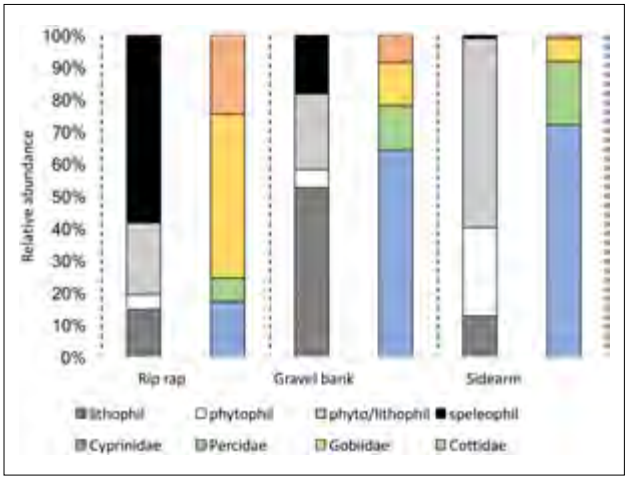

Figure 5. Mean relative abundance of major spawning guilds and families separated for riprap, gravel bank and side arm (after Meulenbroek et al. (2017a))

The study results of the bypass system also demonstrated the use of this man-made river for the reproduction of several species. At the upstream end a mixed set of fish larvae drifted into the system deriving from the Danube; the subadjacent sampling point downstream at the end of the pool pass is dominated by speleophilic (75–85 %) (particularly *Neogobius melanostomus)* and equal shares of lithophilic and phytophilic species. We hypothesise that especially the boulders at the thresholds between the pools are massively used by Gobiidae for spawning. In contrast, at the stream section the majority of the caught larvae consisted of lithophilic (55–66 %) species, foremost by *Chondrostoma nasus, Barbus barbus* and *Squalius cephalus.* In total, 22 fish larvae species were found in the bypass. The repeated capture of Rhodeus amarus larvae also reveals the occurrence of mussels, which are a prerequisite for the reproduction of this ostracophilic species. The study proves that many species have accepted the surroundings as a habitat for different life stages. The reproduction evidence of this species composition corresponds to a natural side arm or tributary of the Danube system. Therefore, it serves as an important refuge and key habitat for the conservation of a variety of endangered species. It is one of the key principles in ecology that habitat heterogeneity increases biodiversity. This is also shown at the bypass. The different sections provide conditions for different ecological guilds and therefore consequently increase species richness. Up to now, the focus for the implementation of fish bypasses is mostly driven to provide migration corridors. With the background knowledge that the Danube was originally a braided river with highly diverse habitats and in order to achieve the requirements formulated in the EU-WFD, a systematic approach for the creation and connection of habitats will be necessary to improve the ecological situation at large rivers like the Danube. Especially the provision of functioning spawning and juvenile habitats is one of the most essential tasks to strengthen the remaining fish stocks and should be considered when planning and implementing fish passes or other artificial waterbodies. However, such systems also need to be managed continuously for a sustainable functioning (beaver dams and log- or driftwood jams, deepening of the riverbed etc.) (Meulenbroek et al. 2017b).

◀ *Table 1 . Calculated relative distribution (%) of all caught species and families separated for all sampling sites. n=21.126 (adapted after Meulenbroek et al. 2017a, Meulenbroek et al. 2017b)*

Conclusion

The results of fish larvae drift at different shoreline configurations of the Viennese Danube and at the bypass system demonstrate several important aspects:

All the artificial shoreline areas and the bypass are used as spawning grounds by riverine fish species.

- The effect of monotonous riprap shorelines on the spatial distribution and massive spreading of the invasive Gobiidae is clearly documented.
- The relevance of the studied mitigation measures (gravel bank and riparian sidearm) becomes apparent by the reproduction of numerous typical riverine fish species as well as several protected and endangered species.
- The natural-like solution of a bypass system serves in contrast to a hard technical construction – additionally to its migration function – as a key habitat for reproduction.

In summary, the fish-ecological conditions at the investigation area of the impoundment of Vienna/Freudenau have suffered just as much as in other Danubian impoundments (reduction of biodiversity and abundances of the typical riverine fish species). However, the mitigation measures work as a last refuge for these species.

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River bank restoration on the upper Danube between Vohburg and Neustadt/Donau for habitat enhancement and improvement of ecological status

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Status quo

Due to stream regulations implemented in the past 200 years, which allowed straightening of the river and the building of hydropower dams and dykes, the Danube lost its natural dynamics and its diversity in bed and bank morphology. Aside from the free flowing stretches between Straubing and Vilshofen (this reach is free flowing but has

Figure 1. Project area

embankments due to shipping), the banks of the Danube are mostly fixed on both sides by heavy stone embankments squeezing the Danube in a "corset".

Environmentally, the consequences were the loss of flood plains and alluvial habitats and biodiversity. Additionally, because of the steep river banks and the monotonous stream bed, the Danube lost its recreational attraction. While the remobilization of flood plains is difficult to achieve, the restoration of river banks is simple and inexpensive.

Ten years ago the State Office for Water Management, Ingolstadt, in Bavaria started with the removal of the stone corset between Vohburg and Neustadt/Donau *(figure 1)*. On both sides a corridor of 50 m was available for stream bed dynamics and the connection between river and flood plain.

Goals of the project

The goal of the river bank restoration was to improve bank structure and bank habitat and to achieve better interactions between river, riparian zone and flood plain and also improved accessibility for the public.

Various measures were tried to gain a high diversity in habitat and bank morphology for the benefit of fish and macroinvertebrates. Bank restoration started with the removal of the silt depositions along the banks which had resulted from flooding, creating elevated bank structures. Consequently, the riparian zone and flood plains are more often inundated and new aquatic and semi-aquatic habitats can develop.

Implementation

Following are some examples of river bank restorations. The measures were undertaken as "maintenance" without the need for water permission actions.

- **Bank restoration at Vohburg/Gaden – Removal of embankments and construction of steer groins**

Starting in 2010, riprap was removed and the stones were used for building 8 to 10 m long triangular steer groins along the bank *(figure 2)*. The groins are slightly inclined with the current which created alternating overflowing and non-overflowing sections. They guide the water flow to the unprotected banks and initiate side erosion, bank and flow diversity (zones for rheophilic species with high flow and zones for more limnophilic species with low current) and create varying depths and little bays with various substrates. Dead wood *(figure 3)*, bundles of willow branches and trunks of trees were used sometimes to emphasize the effects and created new habitats.

- **Bank restoration at Pförring - Removal of embankments and construction of flow around steer groins**

Figure 2. *Steer groins using rocks from embankments, covered during medium discharge*

Figure 3. *Introduced dead wood from the riparian zone in the inter-groin field*

Figure 4. *"Island groins" with shallow gravel banks and side streams*

Similar to the groins described above, oval groins where the current has to circle around, were built within 5 m from the shore, 10 m long and slightly inclined to the current. They act like small islands producing high flow and substrate diversity with side streams *(figure 4)*. While the rocks from the embankment were used for building the groins, the silt depositions had to be removed by chain dredger and trucks *(figure 5)*. They were used for dyke construction nearby.

Figure 5. Removal of embankment and silt deposition by chain dredger

Figure 6. Shallow water zones with gravel banks

- **Bank restoration at Pförring - Removal of embankments and creation of shallow water zones with frequent overflows**

Shallow water zones allow good interaction between river and riparian zones through frequent flooding. These lenitic zones provide habitat for many macroinvertebrates and fish fry. The rocky-sandy beach offers pioneer species like sand pipers and ground beetles (Carabides) better habitats and provides recreational areas for humans.

At the start of restoration silt depositions were removed to the original level and the extracted material was used for dyke restoration. After clearing the foreshore, the embankment rocks were shifted towards the Danube. In this way aquatic and semi-aquatic zones were connected and accessibility for humans was made possible *(figure 6).*

- **Bank restoration at Pförring – Removal of embankments and creation of treed islands in the riparian zone**

In agreement with the Nature Conservancy, areas with silver willows on elevated banks were protected and not removed during restoration work. They remained as treed exposed islands surrounded by flowing water and supply with their "aquatic structure of disturbance" and dead wood greater habitat biodiversity for fish larvae and fry.

- **Bank restoration at Neustadt on the Danube – creation of a new adjacent water course**

A former arm of the Danube which was connected only downstream was opened upstream in order to create a 250 m long adjacent water course. Lateral connections in the channelized Danube are very important for habitat enhancement, especially for typical Danube fish species like Streber *(Zingel streber)* or Danube roach *(Rutilus pigus).* Also, when flooding occurs, which is now more frequent, it can more easily reach the plain. Flooded riparian zones which for example enhance soft wood development are very limited on the Danube River.

Conclusions

The hydro-morphological bank restorations and the combined aquatic and semi-aquatic habitat enhancements have produced good ecological results. With little economic expenditure, morphology of river banks and habitat diversity was improved in a short period of time. The Danube is now no longer just threatening due to flooding but a living river with a social function.

And, last but not least, the restoration measures are a further "brick in the wall" for the European Water Framework Directive (WFD) in order to improve the ecological status of the Danube. These measures are in compliance with the management plan required by the WFD and will be undertaken along other stretches of the Danube. Spawning beds for rheophilic fish species and new habitats for macroinvertebrates are the focus for further restorations.

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Fisher´s knowledge and governance: some general reflections

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"They never ask our opinion! They take decisions in their offices and have no idea how fish look like!"
(Nelu, Danube Delta fisherman)

15 October 2009. It has been six months since I am in the Danube Delta doing fieldwork for my PhD thesis in anthropology. I am studying the human-environment relationship and the conservation of natural resources in a protected area: The Danube Delta Biosphere Reserve. It took me some time to be accepted by the local community, establish a trust relationship and have the opportunity to speak and discuss with them about the problems they were facing and the conservational and management issues encountered at local level.

"Are you still here?!", "You're leaving tomorrow, isn't it?", "What are you looking for at the fishers' meeting point?! The beach is on the opposite side!", "Are you a journalist?", "Do you work for an environmental NGO?" These were the questions I was addressed for a period of approximatively three months. It was quite strange for the inhabitants and especially for the fishers to have someone that daily was interested in their activities, asking many questions about fishing techniques, local management and conservation practices, traditions, tourism development and expressing the will to go fishing with them. I was a "professional stranger" (Agar 1996) and my presence in the village and questions were somehow disturbing the normal course of people's lives.

"Why do you want to know all these things? No one is interested in what we are doing here! The government officials know only to dictate rules and promulgate laws, protect nature and pelicans and control if we are following their measures! However, you know, bad rules are made to be broken! They [government officials] never ask our opinion! They take decisions in their offices and have no idea how fish look like!" (Nelu, Danube Delta fisherman)

This last sentence made me think a lot. As we know, great part of the scientific literature concentrates on the topics of governance, natural resources conservation and communities (Carrier, West 2009, West 2006, Orlove, Brush 1996) and several management and conservation questions have been raised. How are scientists supposed to act? In which manner? Should we take into consideration local communities and interrogate their views and perceptions? Is it possible to "govern nature" (Selmi, Hirtzel 2007) by giving rules that are imposed from the "high sphere" and are expected to be adopted by local communities? Or is it the nature that is governing us? Are fishers mere executors of rules or can they be co-creators of new management knowledge? Nonetheless, of what kind of rules and regulations are we speaking?

Judging by what the Danube Delta fishers told me, we deal with rules that have been planned for rather than planned with. All this in the context of coastal communities was neglected, for too much time, in the planning for conservation and management of protected areas.

At a first glance, it seems that everything is dictated by a "culture of conservation" (Rettie 2009: 66) that does not take into consideration peoples and their needs and where there is no dialogue and communication. But, dialogue is essential for the local and regional sustainable development and local communities should be accorded the right place and active role. Moreover, their knowledge but also their resilience should be used in the creation of management practices. Unfortunately, sometimes we deal with "imported solutions to hypothesized problems" (Geoghehan 2009: 113) that are not adapted for each context, be them connected to fishing bans or denied access to protected zones.

Figure 1. *Fisher explaining the use of one fishing techniques practiced for the Pontic shad fishing (ro. "setca"). Credit: Georgeta Stoica, 2013*

Figure 2. Fishers at the fishing collecting point (ro."cherhana"), Danube Delta, Romania. Credit: Georgeta Stoica, 2008

In different case studies and regions in the world, attempts have been done in order to put the basis of a framework for participative governance in relation to the management of natural resources in pursuance of suitable solutions for the conservation and protection of resources or management of marine protected areas ruled by the communities. In some cases, it worked in others not and usually the ("negative") outcomes were connected to the conflict concerning the access to natural resources and the lack of empowerment. The effort to include fishers' knowledge and their perceptions and representations of the environment in management practices was considerable but at times, the different stakeholders were not speaking the same "language" and wrongly, it has been said that fishers' knowledge was not of "scientific interest" opening in this way a huge gap between scientists, fishers and policy officers.

But how can we reduce the likelihood of conflicts connected to the access to natural resources and their management if fishers' knowledge is erroneously considered to be "marginal" and not "so interesting"?

Through exchanges, interviews and conversations with fishers, their knowledge can be applied for designing management plans considering also the present and past social and environmental conditions. Just to give an example, fishers' knowledge on fish migration, seasonality, different fishing places might be useful for the analysis of stock assessments; data concerning fishers' annual catches might inform about the ongoing changes; or fishers can give information about fish behaviour, spawning locations, larvae and juveniles, fish diseases. All these data can be analysed at a scientific level and then processed in collaboration with the local communities for the implementation of measures that sometimes, considering the "accelerated changes" (Eriksen 2016) of the society and of the environment, demand the implementation of immediate measures.

The urgency of management measures and policy decisions

Take urgent actions to combat environmental degradation and species extinction.

It is urgent! It is vital! It is imperative! How many times haven't we heard discourses on the urgent actions to be taken by the local governments or decisional institutions? All this in a very short interval, that didn't offer too much time for the implementation and for a right consideration of different points of view and especially without taking into account local communities.

As we know for doing research, we need time and the amount of time can be different from one discipline to the

other with considerable differences between social and natural sciences. The questions to be addressed in this case are: How scientists answer to this urgency and how do they contribute with their studies to the good implementation of rules? How can we "translate" the "scientific knowledge" and render it readable to the eyes of the people implied in the setting up of politics? In this sense, scientific expertise is essential for the putting up into practice of politics but the main point resides in the capability of "translating" in simple way "complex" concepts by means of synthetic documents.

This would not be complete without including "fishers' knowledge" and representations about nature and conflicts concerning nature management. The solution to the different environmental problems and the need of urgent actions is to be found together by implying the different stakeholders in participatory approaches and by using a citizen science approach. For doing this, fishers have to be empowered and trust relationships have to be created. One of the objectives would be to integrate fishers' knowledge to survey data and scientific knowledge in order to understand the environmental and cultural changes. This could also empower fishers to participate in decision-making and could bring together fishers, fisheries managers and scientists. Moreover, this could help to share experience and knowledge between different countries but will also help to identify and analyse problems and plan solutions based on fisher's knowledge by mobilizing their knowledge to improve fishers´ management.

For coastal communities, fishing has been a vital part of people's life for generations and their knowledge about fish behaviour, fish species migration, feeding, conservation, fishing techniques, will be useful not only for natural scientists (biologists, geneticists, etc.), social scientists (anthropologists, sociologists, economists, etc.) but also for management of decisional institutions.

Useless to say that time is needed for scientific research, local communities' involvement by creating moments of attentive listening, sharing of information that might be innovative in terms of management and policy measures and decisions but also for the education of future generations.

Final remarks

I would like to finish this short reflection with one question that I was addressed when presenting to the Danube Delta inhabitants the results of my PhD research: "Did you find a solution for our environmental and conservation problems?" (Valentin, Danube Delta inhabitant).

Figure 3. *Danube Delta fishers during the Pontic shad fishing season. Credit: Georgeta Stoica, 2008*

It was hard to give an answer to such a problem especially when you are expected to help with your studies and propose solutions that might have repercussions at a local level. I do consider these solutions can be found in interdisciplinary research approaches.

Interdisciplinary research has never been easy and by definition, it integrates perspectives and methods from two or more disciplines. Excellent scholars and talented leaders are needed for the integration of the research work but this has to be accompanied by a solid knowledge of each discipline involved in a fertile dialogue. A dialogue that implies a deep change of the research objects and theoretical frameworks. In order to succeed in the research process, it is essential to use a common frame of reference, shared theoretical tools, and a rigorous "technical" language.

In this participatory approach, everyone needs to interact with each other in order to understand what happens by encouraging discussions and changes between the different actors. In this way, the survey will take place in a "permanent research laboratory" involving local communities, social and natural scientists. Thus, the research is not a model of top-down intervention, but a discussion and exchange between the different stakeholders about human-environment relationship and nature protection that integrates the questions and needs of the society into research and provide feedback from research to the society.

Only in collaboration with local communities a better understanding of fishers' perceptions and cognitions can be established and their needs integrated so that new information can be provided and used in fisheries management which accounts for the requirements of nature protection. Of course, this can be done in a common effort and reciprocal dialogue and trust between social and natural sciences, fishers and policy officers.

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News and Notes

EcoManAqua – A CEEPUS network fostering mobility of students and university teachers in the Danube basin

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An EU-project funded under FP7 (DANCERs) identified major short comings in joint university education programs related to integrated river basin management (Irvine et al. 2016). In particular, a coherent network related to training in aquatic sciences, water management and sustainable development in South East Europe is lacking. Following this conclusion, a group of scientists from Central, Eastern and South Eastern Europe got active and established the network "Ecology and Management of aquatic ecosystems in Central, East and Southeast Europe" (Acronym EcoManAqua). EcoManAqua was accepted as umbrella network by the program CEEPUS, the Central European Exchange Program for University Studies. CEEPUS is an international exchange program which provides mobility grants for university students and academic teachers among member countries in Central and Eastern Europe and the Balkan Peninsula. It is the product of an international agreement signed by the member states of CEEPUS.

The network comprises 15 universities from 11 countries out of which 10 are situated in the Danube River Basin. Apart from the University of Natural Resources and Life Sciences Vienna which acts as coordinating institution, these are relevant faculties from the University of Sofia, the Jossip Juray Strossmayer University of Osijek, the University of Zagreb, the Palacký University Olomouc, the University of Bucharest, University of Belgrade, University of Ljubljana, the University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, and the Dunarea de Jos University of Galati. The University of Tirana, the University of Montenegro in Podgorica, the Charles University in Prague and the University of South Bohemia České Budějovice as well as the Warsaw University of Life Sciences are located in adjacent river basins.

The motivation to establish a network in interdisciplinary aquatic ecosystem sciences was (1) to address major challenges related to the alteration and modification of aquatic ecosystems such as rivers, wetlands, lakes and coastal waters, (2) to address the interplay with human

society and (3) to provide means to improve the scientific excellence of all involved partners by intensified and focussed educational activities. EcoManAqua focuses in particular on aquatic biodiversity change (e.g. invasive species), the imbalance of the sediment transport as well as hydromorphological and water quality change. It acknowledges that varying and intensifying human uses led to societal conflicts related to the provision of riverine ecosystem services such as production of goods, transport, power generation, limited self-purification potential and regulation of the regional water balance, tourism and conservation and restoration of heritage sites to name but a view. These management challenges are emphasized by ICPDR and they are expected to lead to even more severe changes, if future drivers of change such as climate change and demographic shifts and the effects of multiple pressures are taken into account. The activities implemented by the network aim in general to achieve a better understanding of complex interacting societal and environmental processes.

Short and long-term students and teachers exchange including joint supervisions of master and PhD students as well as further educational joint activities should help to

- Establish a well-working active network in the field of aquatic sciences and ecosystem management based on the common strategy of the network
- Increase and improve the number of students' and teachers' mobility and establish joint activities such as summer schools or short term excursions
- Exchange expertise to foster targeted joint research activities especially in Central, East and South East Europe-Programs.
- Explore the potential of joint programs based on existing programs and initiate new activities in that direction to guarantee long term cooperation
- Disseminate, promote and publish network activities in cooperation with existing networks and based on the well-established capacity among partners
- Improve the level of mutual use of ICT communication (SKYPE, web conferences, other web based tools, e-mails) and of communication tools of involved partners
- Built bridges to further EUSDR initiatives and intensified linkages to other existing networks and stakeholder groups.
- Foster contributions to international conferences in the field of interdisciplinary aquatic sciences and ecosystem management in the region in the coming years.

Further details on the programme and mobility opportunities can be found at http://www.ceepus.info/#nbb.

Irvine K, Weigelhofer G, Popescu I, Pfeiffer E, Păun A, Drobot R, Gettel G, Staska B, Stanica A, Hein T, Habersack H (2016): Educating for action: Aligning skills with policies for sustainable development in the Danube river basin. Science of the Total Environment 543 A, 765-777

HR 21 – a new interdisciplinary Doctoral School to address present and future challenges of Human-River-Systems in the 21st century

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Inter- and multidisciplinary approaches are required today by many research funds and programs. Interdisciplinarity is a major term and guiding principle of a multitude of individual research projects. Many researchers acknowledge that this is needed to solve the pressing challenges of today's societies and the earth's environment. Nevertheless, it is often concluded that the term is used as a mere buzzword and lacks adequate consideration in the practical implementation of projects. One reason might be a lack of training and expertise which is necessary to tackle the complexity evolving from inter- and multidisciplinary research.

Recognising the need for education in inter- and multidisciplinary research, the University of Natural Resources and Life Sciences, Vienna (BOKU), has developed and established a new Doctoral School. PhD-students shall be enabled to address and understand riverine landscapes as complex systems which are subject to inherent natural dynamics and processes and simultaneously affected by long-term multiple pressures which are driven by changing societal demand, far-ranging technical interventions and an intense use of partly conflicting ecosystem services. The industrialised riverine landscapes (IRL) we find today are heavily modified and thus hybrid systems. Complex interaction between environment and societal processes and the co-evolution of these two spheres urgently require a socio-ecological systems approach in both science and management.

The faculty of the doctoral school involves 15 scientists from BOKU and the Alpen-Adria Universität Klagenfurt (AAU)/ Faculty for Interdisciplinary Studies in Vienna (IFF). They join their expertise in terrestrial and aquatic ecology, engineering and technical sciences focusing on water engineering in river systems, social sciences and humanities addressing land and water use competition, ecosystem services, spatial planning, (urban) infrastructures and resource demand (e.g. hydropower, water supply) as well as cultural programs in the past, present and future of IRL.

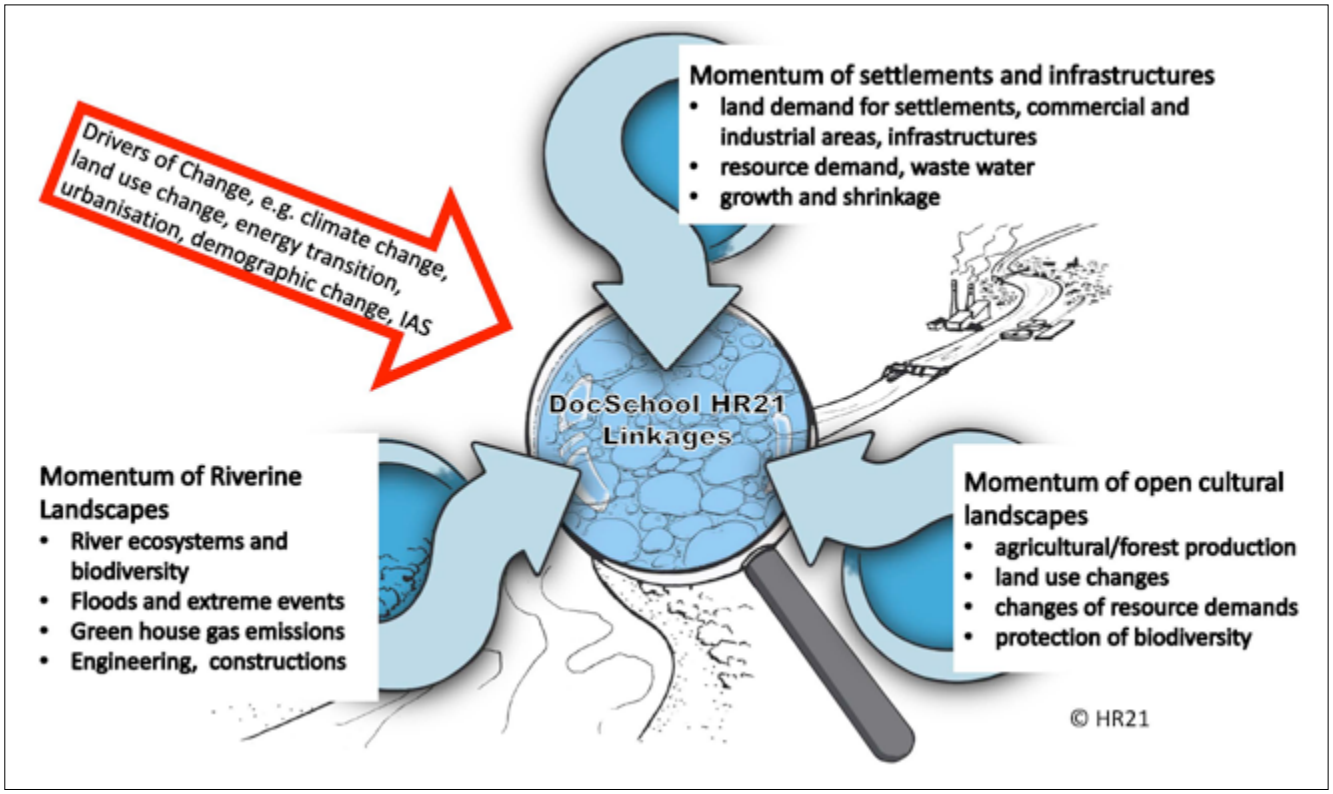

Figure 1. The interdisciplinary approach of HR21

HR21 aims to address critical knowledge gaps in IRL- and coupled socio-ecological systems research as well as to develop new analytical and modelling tools. A new generation of scientists shall be trained in a multi- and transdisciplinary environment and interdisciplinary Human-River-System research shall be strengthened. HR21 targets to provide a new interdisciplinary understanding of the future development of IRL and their efficient and sustainable management. The program starting in 2018 will also foster international cooperation by creating an international working atmosphere at several levels (e.g. international experts in mentoring teams, research stays abroad, guest scientists) and will establish linkages to other national and international programs, thus increasing the number of PhD students in that field.

The ultimate long-term goal of HR21 is to establish a centre of excellence for socio-ecological system research of riverine landscapes in Austria. The Danube and its tributaries will be a strong spatial focus and international cooperation on the catchment level is a clear necessity in this new endeavour.

INADAR – a EU-Life Project addressing current problems in a modern river management in Southern Germany

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EU-Life Project INADAR (Innovative Approaches to Dam Restoration and the Environmental Improvement of River Banks)

Many dams along the impoundment area of barrages are now in need of restoration and must be elevated for flood protection due to increased requirements. For dam elevation the dam is usually widened not on the water but on the air side, resulting in higher land consumption and damages on the riparian forests (often FFH areas). Usually, extensive authorization procedures are necessary and high costs for the rehabilitation occur.

As part of the EU-Life project INADAR, an innovative approach for ecological dam restoration is developed and implemented in two test sites. The restoration and/or elevation of the dams and the improvement of the ecological situation according to the Water Framework Directive (WFD) should be fulfilled effectively and economically in one process. The focus is the installation of so-called 'eco-berms' that ensure dam stability as well as the improvement of the ecological situation in the shore area of the dams. Due to the implementation of the measures solely on the water side damages on the riparian forest can be completely avoided.

The specific project objectives are therefore:

- Efficient restoration of embankments with and without dam elevation
- Significant improvement of the ecological situation in the shore areas
- Avoidance of damages on the existing riparian forests
- Lower costs for dam restoration and dam elevation and thus lower barriers for necessary flood protection measures and environmental improvements
- Development of simplified approval processes by developing general conditions for the application of 'eco-berms' together with concerned stakeholders

The 'eco-berms' are suitable for all dams, where the discharge capacity does not play a key role for flood protection, e.g. in the storage area of hydropower plants or waterways.

For the pilot approach in the Upper Danube, two pilot projects are developed under supervision of the BEW (Bayerische Elektrizitätswerke GmbH) in partnership with regional stakeholders. The project is accompanied and evaluated by the University of Innsbruck, the Aueninstitut Neuburg and the TU Munich.

Status of the progress and outlook

Within the next months, the measures for the test sites at the hydropower plants Offingen and Oberelchingen will be planned in detail. In parallel, the evaluation concept is developed. First surveys of the actual situation, which serves as a reference state for the effect of the 'eco-berms', are realized. The installation of the test sites in the storage space Offingen has taken place in fall 2016, the test site at the Oberelchingen is under construction since spring 2017.

Figure 1. Installed 'eco-berm' at Offingen hydropower plant. On the opposite side there is still the traditional concrete embankment.

Other aspects that will be part of the project include simplifying the approval process together with the relevant stakeholders as well as the promotion of the project results on EU level. For more information, see www.inadar.eu.

Lives Among Waters – a film from Oana Ivan

On May 16th, BOKU University hosted the Austrian premiere of the documentary "Lives among Waters", a film about the life in the Danube Delta, made by Dr. Oana Ivan.

The movie was presented in the frame of the CEEPUS network EcoManAqua in the workshop "A view on the Romanian aquatic life – endangered or invaded?".

The documentary is focused on understanding the livelihoods of the fishermen living inside the Danube Delta UNESCO Biosphere Reserve. Based on a PhD research in anthropology, the film follows the story of the local people over a period of seven years looking at the ways tourism and environmental protection deeply affects the community, as locals are being marginalized and ignored.

After the presentation, filmmaker Dr. Oana Ivan was present for an exchange with the audience. The discussion pointed the burning issues that should be on the top agenda of the policy-makers and sustainable development projects managers for protected areas. As Prof. Thomas Hein emphasized, the current management approach in the Danube Delta is partly the result of the gap between institutional approaches and the living situation of the local population. The local knowledge and historical development of the environment including any aspects of human – nature interactions should be considered when tailoring the conservation programs. The traditional approach of humans against nature has been shown to limit our achievements in more sustainable ecosystem management, while acknowledging the history of a coupled co-evolution of humans and their environment might be a suitable future approach.

The event was organized by Dr. Andreas Zitek, and also hosted the presentation of Dr. Daniel Cocan from University of Agricultural Sciences Cluj Napoca , invited at BOKU through a mobility grant of Ecology and Management of Aquatic ecosystems in Central-East and South-East Europe program (through CEEPUS).

A trailer of the film is available at:
https://www.youtube.com/watch?v=QcKi_KpRmP0

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Hydrological catchment of the River Danube

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