The Danube River Basin Management Plan (DRBMP) – challenges of an integrative policy

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1 Introduction

The adoption of the Water Framework Directive (WFD) represented a step forward for the European water law, as it integrated the recommendations of previous water directives, while introducing also new concepts, such as the river basin approach (Van Rijswick et al., 2010). This requires an increased transboundary cooperation in water management, at international and regional level, since river basins are hydro-geographical units not limited by political borders. Consequently, over the last decade water management has gradually evolved from fragmented local policy towards an integrative and interactive approach at larger scale (Wiering et al., 2010).

Encompassing 19 countries with different economic, social, cultural, and environmental heritage, the Danube River Basin (DRB) is the most international catchment worldwide (Sommerwerk et al. 2010). Also, the political background differs considerably: while 10 countries are EU Member States (MS) and one is in accession, 8 are non-MS and not obliged but willing to comply to EU legislation.

In these circumstances, cross-border cooperation to achieve an integrative water policy is a difficult task. However, based on the long history of international cooperation (Lindemann, 2006), and under the guidance of the International Commission for the Protection of the Danube River (ICPDR), the governments of the riparian countries cooperated well to produce the Danube River Basin Management Plan (DRBMP) and to establish a Joint Program of Measures (JPM; ICPDR, 2009). Science contributed significantly by providing improved field and lab methodology, basic data sets, predictive models and conceptual strategy.

2 DRBMP 2009

The DRBMP is a significant update of the Roof Report (ICPDR, 2005) and encompasses most of the available information on the DRB with regard to the present status of waters and main pressures to the aquatic environment. However, since EU legislation is continuously up-grading, aiming to assure sustainability (COM 400, 2009) and considering increasing pressures of human society (TEEB, 2008), the management plans should be considered as an interactive process: the future RBM cycles must continuously up-date the Significant Water Management Issues (SWMI) analysis and the JPMs to assure the implementation of EU requirements.

This paper emphasises major items that need further consideration and suggest some measures that might improve the implementation process.

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3 DRBMP – "Next generation"

Modern river basin management includes at least three major issues of WFD policy:

- internal relationships between water quality, quantity and hydromorphology, groundwater and surface water, natural water cycle, etc., combined into an integral water policy.
- external links with spatial planning, agriculture, nature conservation, urban and rural development, transport, tourism, etc.
- cross-border integration by considering the river basin as an administrative unit.

In addition, the Flood Risk Directive stimulates cooperation in flood risk management (e.g., warning systems). Therefore, transboundary cooperation reflects clearly an integrative management (Wiering et al., 2010) aiming to achieve sustainable development as an overarching long-term goal, where economic growth, social development and environmental protection are mutually supporting each-other (COM 400, 2009).

In order to comply with these new trends, we would like to emphasize several major items that need further consideration for the next RBM cycles:

1. **A conceptual shift of management strategies** – due to the strong links between water and land, the terrestrial ecosystems should be included in water management policy. Land use as well as disturbed interaction between aquatic and terrestrial biota affect water quantity and quality, river connectivity, and erosion processes. While trends for social and economic development are considered in RBMPs to harmonize the measures and integrate the best solutions, they need to be better balanced with ecology to mitigate environmental impacts.
2. **Integration of ecosystem services –** although the world is governed by money and price, many ecosystem services (i.e. benefits provided by the environment) have an intrinsic value that can hardly be conversed into money (e.g. biodiversity, genetic pool, oxygen supply, etc.). Together with the extrinsic value (such as food provisioning, water purification, climate and atmospheric regulation, flood/drought mitigation), the ecosystem services are vital for the human society. They need increasing recognition and integration in policies as recommended by TEEB (2008) to improve the well-being of present and future generations. In this context, the function of aquatic and terrestrial biocenoses needs further research and public recognition as this is crucial in assuring the good ecological status and water quality.
3. **Climate change** – there is increasing evidence of environmental changes due to global warming, both in terrestrial and aquatic ecosystems. The impact is also documented for the DRB, such as glacier melting in alpine headwaters, reduced river discharge and increased air and water temperatures (Sandu et al., 2009). Hence, combating and mitigating these effects by a proper water management policy became a key priority at EU level. Early actions are needed to build resilience in water and connected sectors (e.g. agriculture, transport, energy, tourism, industry, etc) as the impact driven by climate change is expected to be exacerbated in the future; moreover, recovery of natural water systems from unsustainable use (e.g. over-use of groundwater aquifers, over-exploitation of surface water resources) may take a long recovery time (COM 147, 2009).
4. **The ecological importance of wetlands** – their role is mentioned especially in connection with ecosystem services such as climate change mitigation, but they are important also with regard to water purification, groundwater supply, biodiversity, flood mitigation, human health, etc. Such areas should be protected from excessive use, in particular by regulation of land use, infrastructure and spatial planning. "*Where wetlands reduce floods, recharge groundwater and increase dry season flow, their hydrology is working synergically with water-resources managers and flood-defense engineers. Where wetlands have high evaporation demands or generate flood-runoff, they may create or exacerbate water management problems. Whatever functions they perform, wetland management should be an integral part of water bodies management...*" (COM 147, 2009).
5. **Protected areas** – the future RBM plans should intensify the focus on strong pressures, resulting conflicts and possible solutions. Raising awareness at basin level about their importance is needed to strengthen legal implementation. Multi-Criteria Decision Aid (MCDA) methods and Decision Support Systems (DSS) should be introduced and widely applied, as exemplified in the

Vienna Lobau Project (Hein et al., 2009). The use must be balanced and limited with regard to areas which are fully, partially or not protected. Further, the frequent overlap/hierarchy of existing (or new) status of protection on local, regional, national and international level must be considered in legal implementation (Sommerwerk et al. 2010).

6. **Invasive alien species** – the global spreading of alien/exotic species has dramatically increased in the past decades mainly due to human transport and mobility. There is intense scientific research about benefits and negative impacts of invasive terrestrial and aquatic species. Commonly native resident species are suppressed and possibly going extinct as usually the invasive species feature behavioral and functional advantages. Many examples are known where also economy was strongly affected (Reinhardt et al., 2003). Although the role of invasive species is still debated, they should be considered in future strategies (EC 11412, 2009).

7. **Overexploitation of natural resources** – overexploitation has abiotic and biotic components. For example, excessive gravel exploitation for commercial use and navigation purposes can enhance river bed incision and hence lower the groundwater table, highly impacting the hydromorphology. Overexploitation in fishery may lead to the extinction of species, as demonstrated with the highly endangered Danube sturgeon populations. Overuse of groundwater resources for drinking water, household consumption, gardening and irrigation cannot continue forever. In particular, water overuse during droughts, when the aquatic ecosystems are under high stress, should be limited. In the long term, alternative solutions should be considered, e.g. restricted use of hydropower plants; promotion of wind, geothermal or solar energy; favoring railway transportation over navigation; limiting water abstraction for agriculture by implementing efficient irrigation techniques, etc. In the context of sustainability, such excess uses must be better balanced and limited by harmonized law and regulation.

8. **Groundwater** – the Groundwater Directive refers not only to the transboundary aquifers, but also to the national ones; therefore, it is important that national groundwater bodies are considered and protected as well, as groundwater represents the largest freshwater body in the EU and a major source of public drinking water supply in many regions (Dir. 2006/118/EC). Although groundwater biota is not considered by WFD, its existence needs attention as the aquatic communities contribute to the improvement of water quality (e.g. microorganisms, phreatic fauna). Also, the effect of erosion/deposition on groundwater should be considered (see item 7). From a hydrological standpoint, pathways and flow direction, as well as in-/ex-filtration zones of major groundwater bodies should be investigated, documented and protected.

9. **Future Infrastructure Projects (FIPs) and hydromorphological alterations –** FIPs often impact aquatic ecosystems, their hydromorphological structure, in particular. The EU standard for assessing river hydromorphology (EN 14614:2004) must be applied to assess the status and alteration of rivers. In particular, this is crucial in the Middle and Lower Danube (Green Corridor) and the Danube Delta. Hence, FIPs should be considered in an integrative way at basin level, due to their interconnectivity and cumulative impact: e.g. the planned FIPs affect consecutive stretches of Tisza and Danube Rivers, with significant consequences visible in the next decades; the need for proper SEA/EIAs, and balanced measures between technical and environmental solutions should be emphasized. This applies specifically to priority issues such as navigation, hydropower dams and flood protection structures on river banks. To comply with WFD “no future alteration” requirements, the natural river course should not be affected (i.e., no channelization) and the impact on natural ecosystems must be mitigated by respecting the priority of prevention over mitigation and compensation.

10. **Sediments** – although sediments are not explicitly mentioned by WFD, they are an integral part of aquatic ecosystems and a crucial component of “good ecological status”: They provide habitat for biota (benthos, fish, macrophytes) and can adsorb/store nutrients and hazardous/toxic substances like heavy metals and persistent organic pollutants (POPs). Suspended and bedload sediments reflect erosion and accumulation processes, hydromorphological structures (river bed, banks, islands, riparian zone) and groundwater connectivity. Disturbance by dams, gravel exploitation, dredging and channelization has a major negative impact on the riverine ecosystem.

11. **Water abstraction and hydropeaking** – while it is important to define the minimum ecological flow for water abstraction, hydropeaking (the artificial water level fluctuation, defined as the ratio of Q_{max} and Q_{min}) demands the definition of the variation range for relevant ecological parameters such as discharge, water temperature, sediment/suspension load, etc. There is growing experience and scientific research into the problem of hydropeaking: case studies have shown

that a ratio Q_{max}:Q_{min} >5:1 is not acceptable from an ecological point of view, e.g., for fish populations (measures of remediation can be retention basins to break the peak flow); the "ideal" and ecologically acceptable ratio is <3:1; ratios between 3-10:1 may be acceptable under specific conditions but need to be thoroughly investigated. In addition, the rate of water level change and the change of water temperature induced by hydropeaking should not exceed 15 cm per hour and 5°C, respectively. Special emphasis needs to be given to sediment transport, since hydropeaking fosters colmation of the river bed sediments. Hydropeaking must also respect seasonally variable minimum ecological flow in an ongoing debate between scientists, users and politicians.

12. **The efficiency of fish passes –** fish passes are vital to maintain/re-establish the longitudinal connectivity. Theoretically, a good fish pass allows passing of all resident fish species and all life stages to ensure local and anadromous migration. These requirements must be approached as closely as possible. Further, in large rivers (width about 100 m and more) two fish passes on either bank should be established because most fish migrate along the banks. The function of fish passages is dependent on fish behavior and hydraulics and should be monitored.

13. **Water quality**

13.1. Reducing diffuse sources of pollution in agricultural areas – end-of-pipe solutions should be abandoned by applying best available technology (BAT) and practice in cultivation and fertilizer application to reduce agrochemicals and nutrient input to surface- and groundwater bodies. In this respect, creating buffer strips along small streams and stagnant waters are a successful strategy to mitigate pollution. Such measures can lead to significant water quality improvement downstream in the catchment (large rivers, lakes, oceans). Soil solidification, erosion and contamination are often neglected phenomena that reduce fertility, bias hydrological processes and impact human health.

13.2. Improved efficiency of Waste Water Treatement Plants (WWTPs) – in order to further improve water quality, the target efficiency of WWTPs should be higher than the present minimum requirement set to 80% for TP and 70-80% for TN by the Directive 98/15/EC. State-of-the-art standard technology allows a removal by 85-90% of C, N and P; applying BAT in specific situations can increase removal to 95% for C, >90% for N and 98% for P; also strategies to remove contaminated sludge are needed. The degree of connection to sewer collecting systems and their maintenance should be gradually improved, particularly in the Lower Danube Basin. However, alternate cheeper solutions as using wetlands or trickling filters in remote areas may be considered.

13.3. Hazardous substances – although a high number of chemical substances is currently in use, the risk assessment of toxic pollution in aquatic ecosystems is still based on few target compounds, the traditional monitoring program focusing on substance, rather than effect monitoring. The new Directive 2008/105/EC on environmental quality standards (EQS), aims to ensure a high level of protection against the risks of priority substances and other pollutants to the aquatic environment. A reliable diagnosis, prediction and mitigation of toxic impacts on aquatic ecosystems require effect-based identification of key hazardous substances, analysis, modelling and assessment of bioavailability and food web accumulation as well as a better evaluation of monitoring data on contamination, toxicity and ecological quality on a basin-wide scale (Teodorovic, 2009).

Monitoring is virtually impossible, but their proper retention in WWTPs (e.g. by adding supplementary steps such as charcoal filtration and ozonation) may reduce the risks for the aquatic ecosystems and finally, for human health (many of these products having sub-lethal effects at endocrine or neurological levels). However, policy should foster product control and recycling processes in order to protect the environment from hazardous chemicals.

4 Measures to improve cooperation

The EU policy is shifting towards a new integrative approach, promoting changes also at regional or national level; it is clearly stressed that "*business-as-usual is not an option and if no major new policy are put in place, past trends of biodiversity and ecosystem services loss will continue*" (TEEB, 2008).

However, transposing the international and national legislation into a real cooperation to improve the implementation, is a major challenge (Sommerwerk et al. 2010). According to Wiering et al. (2010) three major approaches are a prerequisite to achieve a successful cooperation:

- negotiation as a process to compromise between policy, interests and resources.
- analysis of cooperation (including norms, rules, procedures that guide the interactions between policy actors) by establishing cross-border institutions that contribute to water management.
- shifting the focus of policy making from organizational forms (actors, resources, institutional rules) to the content (ideas, concepts, problem definition, common goals).

The last approach focuses on discursive and cognitive processes; in this respect, a major role is played by transnational alliances of scientists, who share common knowledge about the environmental problems, but also common beliefs and objectives that are considered and integrated by the policy makers (Haas, 1990). The links are more easily established when the problem is seen as a joint problem and perceived in similar terms by all actors and when a community of scientists indicates a solution to the problem or encourages cross-border cooperation.

In the Danube River Basin, the JPM will enter now in the implementation phase. Although there is no general rule to guarantee success, several key items may contribute significantly (Wiering et al., 2010):

- availability and willingness to redistribute financial resources
- availability of knowledge
- legally binding commitments that are clear, transparent and feasible
- comparable rules and discourses in the countries involved
- the feeling of solidarity and urgency
- focus on issues that are not politically sensitive
- involving all stakeholders from the beginning may increase the chances of local cooperation

Besides these items, other important aspects are: focus on emerging and existing significant problems; transparency in information and communication will build up trust that is necessary for successful cooperation; leadership with a strong ethical and societal component.

The countries are responsible for achieving the goals and objectives. A closer cooperation and a restricted use of exemptions may lead to better and faster achievements (Van Rijswick et al., 2010). Further efforts should be directed towards the fullfilment of the above mentioned solutions, in order to enhance the implementation process and achieve the „good ecological status".

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