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THEMATIC ISSUE

The role of institutional and legal constraints on river water quality monitoring in Ukraine

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Abstract For achieving any kind of river basin management, monitoring is a pre-requisite: However, for monitoring to be successful, the broadly applicable legal and policy mechanisms for facilitating data exchange, public participation, implementation and compliance must also be present. Ukraine as a member of several international agreements directly concerning management and protection of freshwater, and other broader environmental agreements indirectly affecting transboundary water management, aims to improve its national water management framework by introducing river basin management. This paper examines current gaps between Ukrainian water legislation on RBM and EU and other relevant international water law. Specifically, the paper shows how far monitoring requirements have been fulfilled and identifies shortcomings. The following deficits in river water quality monitoring exist in Ukraine which are (1) biological data are not sufficiently collected by the authorities and (2) monitoring of hydromorphology is not systematically conducted. Taking into account the current political and economic crisis, the paper proposes a short-term oriented solution which is to entrust the River Basin Administrations with more tasks, because they have experience in monitoring, they are directly linked with the State Agency for Water Management that is in charge of implementing IWRM and they are allowed a basic budget for financing staff. But in the long run strategies are to be developed that secure proper monitoring with effective standards and resources for authorities who take over these tasks.

Keywords Ukraine · River basin management · Monitoring · Ecological water quality · Water law

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Introduction

Sustainable water management is currently one of the major global human challenges (Richter et al. 2003), due to rapidly changing boundary conditions like the growing world population and increasing demand in both availability and quality of water resources or the impact of land use change. Water quality monitoring is a key pre-requisite of water management as it is the basis for the assessment of current state of a water body as well as the assessment of changes after measures are introduced. Monitoring necessitates resources of different kinds: human, financial and institutional (Beveridge and Monsees 2012), and especially in developing and transition countries these are often lacking. The paper highlights the importance of monitoring by presenting a case study from the transboundary Western Bug river, specifically focusing on the part of the basin situated in the Ukraine. Although Ukraine is not a member of the European Union (EU), it has demonstrated some willingness to reform its legal and institutional

mechanisms for water management towards closer alignment with European and international legislation. This paper examines current gaps between Ukrainian water legislation on RBM and the European Water Framework Directive (EU WFD, European Community (EC) 2000) WFD and other relevant international water law. Specifically the paper shows how far monitoring requirements have been fulfilled and identifies shortcomings. Of increasing relevance to this topic is the fact that many water bodies in Ukraine are highly polluted (Ertel et al. 2012; Nazarov et al. 2000, 2001, 2004; Kundzewicz 2001; Lebedynets et al. 2004; Vasenko 2005) with implications for human health (ten Veldhuis et al. 2010), environmental integrity (Camargo and Alonso 2006), including both intermediate and long-term perspectives, and concerning economic prosperity (Camargo and Alonso 2006). Furthermore, climate change will impact on water quality and quantity (Fischer et al. 2014; Pavlik et al. 2014). Water management in the Ukraine proceeds in a fragmented way, one key issue being a lack of data (Blumensaat et al. 2012). There is no comprehensive database or understanding of the linkages between the existing multi-level legal and policy instruments for managing transboundary freshwater including those addressing water quality (Moynihan 2013) as demonstrated below in "Uptake and implementation of international and regional rules and approaches to addressing water quality and monitoring". This paper attempts to piece together some of the key instruments and institutions to contribute to building knowledge on the current state of water management, particularly with regard to water quality monitoring in the Ukraine. Because Ukraine has two transboundary rivers (the Danube and the Western Bug River) that affect the river water quality of EU waters, the EU WFD is taken as a central reference point in this paper.

Methodology

The research project International Water Research Alliance Saxony (IWAS) funded by the Federal Ministry of Education and Research (BMBF) sets out to fill the above-outlined knowledge gap and provides some recommendations for key stakeholders (Kalbus et al. 2012). This paper analyzes the Ukrainian water management aims, identifies the gaps in monitoring practices of the ecological status of waters and provides solutions for institutional amendments. The empirical data for the institutional analysis are based on the qualitative expert interviews with 39 Ukrainian stakeholders from politics, administrations, water enterprises, NGOs and scientists between 2009 and 2012. This is accompanied by an analysis of legal instruments and other important documents such as project reports by international organizations such as World Bank or OECD. The recognition of the low temporal and spatial resolution of water quality and hydrology data (Vasenko 2005) led to two comprehensive field monitoring campaigns: The first campaign was conducted by German and Ukrainian over a period of three weeks in September 2009 where water quality conditions (physico-chemical, biological water quality and morphology) as well as the self-purification ability and decomposition were assessed in the Western Bug River basin (Ertel et al. 2012; Scheifhacken et al. 2012; Hagemann et al. 2014). The campaign in May 2010 that stretched over 2 weeks aimed at verifying the 2009 results and to gain information on seasonal variations. The relevant information from the campaign for this paper was what is measured by the Ukrainian authorities and how.

Kemper et al. (2007) developed an analytical framework to analyze river basin management (RBM) and have a specific look at the decentralization process. They point out that certain aspects are important to acknowledge which are (a) the economic development of the nation and the river basin and the distribution of resources among stakeholders, (b) how the decentralization process took place and in how far it can be regarded as a "real" decentralization process, (c) what are the relationships between the central and the local authorities and how are resources—including financial—distributed[1] and (d) what kinds of basin level institutional arrangements exist including established institutions and information channels. As we are not looking at the whole RBM implementation process, we will not take into account all these four aspects with the same intensity.

To present the arguments and results of our research, "Uptake and implementation of international and regional rules and approaches to addressing water quality and monitoring" of this paper firstly provides a broad overview of the uptake and implementation of international and regional approaches to addressing water quality and monitoring in the Ukrainian legislative and policy context. This section explores how Ukraine has initiated the process of implementing international RBM approaches as evidenced by several legal and policy instruments and proceeds by identifying some gaps between international, European and Ukrainian legal and institutional approaches. Significant attention is then given to assessing how monitoring is presently organized in terms of ecological status generally, and biological and hydromorphological indicators in particular. This does not only include technical aspects and methodology but also the institutional embeddedness which means if the rules and regulations are well defined and are safeguarded by enforcement mechanisms. Based on this descriptive overview, "Identification of deficits for

[1] The distribution of resources is crucial in decentralization processes as already mentioned by for example Weingast (2008).

river water quality monitoring" discusses different options to initiate and institutionalize improved and comprehensive monitoring activities. "Options for improved monitoring of the ecological status" then draws conclusions on possible solutions for Ukraine to move forward towards more sustainable river water quality monitoring.

Uptake and implementation of international and regional rules and approaches to addressing water quality and monitoring

Ukraine is a riparian country sharing several transboundary rivers and this section will address the role and relevance of international and regional rules on water quality and monitoring to Ukrainian legal frameworks including discussion regarding Ukraine's uptake of these instruments. Ukraine is a contracting party to a substantial number of international and regional environmental agreements directly and indirectly related to RBM including obligations specifically addressing water quality and monitoring, although it has been less successful with implementation of and compliance with these instruments (Moynihan 2013). An analysis of the extent to which Ukraine has progressed in implementing the myriad of agreements into its national and river basin-specific legislation is beyond the scope of this paper. Instead, a selection of significant international and regional instruments relevant to water quality and monitoring is briefly introduced. The following overview is a short discussion on how some of these obligations have already been translated at both the Ukrainian national and Western Bug river basin levels.

At the pan-regional level (although now open to all UN Member States), the 1992 UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (UNECE Water Convention)[2] Lakes, Mar. 17 1992 (entered into force Oct. 6 1996), reprinted in (1992) 31 ILM 1312 (hereinafter UN ECE Water Convention). and its related Protocol on Water and Health[3] Watercourses and International Lakes, Jun. 17 1999, (Aug. 4 2005) http://www.unece.org/env/water/text/text_protocol.html are two key instruments to which Ukraine is a contracting party (Law of Ukraine No. 801-XIV), alongside the other two Western Bug river riparians, Poland and Belarus. Taken together, these instruments provide an excellent platform for future transboundary water cooperation, joint monitoring and protection of water quality on the Western Bug, as explained below. The UNECE Water Convention includes many obligations relating to water quality (see UNECE Convention Annex III), as well as broader measures to control and reduce transboundary impact. Legal obligations on data collection, monitoring and exchange are core to the UNECE Water Convention (see Articles 4, 5, 6, 9, 11 and 13) and the UNECE also produces further Guidelines on implementing these provisions.[4] The Protocol on Water and Health which Ukraine became party to in 2003 (Law of Ukraine No. 1066-IV) provides specific obligations on the establishment of national and local targets for the quality of drinking water and the quality of discharges, as well as for the performance of water supply and waste water treatment.[5]

One of the most important obligations of the UNECE water regime for Ukraine stems from the procedural obligations regarding cooperation found in Article 9 of the UNECE Water Convention. Ukraine is required together with other riparians to the Western Bug, to establish a joint body which should conduct numerous tasks related to water quality and monitoring.[6] There is currently no joint body between all three riparians of the Western Bug and these tasks are not being fulfilled at the transboundary level between all three countries. Ukraine is making progress at the national level which is discussed below. The UNECE Water Convention also provides an elaborated institutional machinery through its Secretariat, Meeting of the Parties and Working Groups to enable countries including Ukraine to exchange experience and learn lessons on water quality monitoring and RBM more generally (Moynihan 2013). Ukraine could play a more active role in this international platform.

Moving to the EU level, the EU WFD refers explicitly to sustainability throughout its provisions and in particular in Article 1 (Petersen et al. 2009; Klauer et al. 2008). A central objective of the EU WFD is set down in Article 4 (1) which states that groundwater, and all coastal and surface waters should reach a good status by 2015. The continuous monitoring of water status as called for by

[2] Convention on the Protection and Use of Transboundary Watercourses and International.

[3] Protocol on Water and Health to the Convention on the Protection and Use of Transboundary.

[4] UNECE, Strategies for monitoring and assessment of transboundary rivers, lakes and groundwaters (UNECE 2009). http://www.unece.org/fileadmin/DAM/env/water/publications/documents/StrategiesM&A.pdf. Accessed 19 January 2013.

[5] For further analysis on the exact content of the Protocol as it applies to the Ukraine see Moynihan (2013).

[6] These tasks include: (a) to collect, compile and evaluate data in order to identify pollution sources likely to cause transboundary impact, (b) to elaborate joint monitoring programmes concerning water quality and quantity, (c) to draw up inventories and exchange information on the pollution sources, (d) to elaborate emission limits for waste water and evaluate the effectiveness of control programmes, (e) to elaborate joint water quality objectives and criteria, and to propose relevant measures for maintaining and, where necessary, improving the existing water quality, and (f) to develop concerted action programmes for the reduction of pollution loads from both point sources (e.g. municipal and industrial sources) and diffuse sources (particularly from agriculture).

Article 8 EU WFD requires a high level of commitment to a wide range of water quality-related standard monitoring techniques. Transferring EU WFD obligations into practice, monitoring generally comprises standardized field assessment and laboratory processing including intercalibration, data compilation and documentation of the results. Already the process of standardized data collection is an important basis for the establishment of RBM activities to secure monitoring of water bodies and to ensure comparability of the water status (Hering et al. 2010). Articles 11 and 13 EU WFD commit the member states to establish a management plan for each river basin district that includes a programme of measures showing how environmental objectives shall be reached. The selection of measures to be included in the programme of measures should take into consideration their cost-effectiveness (Rode et al. 2008). The development of measures, the assessment of their cost-effectiveness as well as the control of their success also require an advanced monitoring system. Without reliable data and information on the state of the water quality, measures taken can be ineffective and it becomes problematic to evaluate cost-effectiveness of such measures. In the worst case scenario, significant finance can be invested without improvement to the environment.

According to Article 8 of the WFD, the ecological status of any water body needs to be monitored in an encompassing manner using biological indicators supplemented by physical, chemical and hydromorphological indicators. This approach strongly juxtaposes the previous practice in the EU and elsewhere of mere pollution control primarily based on physical–chemical criteria for water quality management. Along with this paradigm shift from an emission-oriented management approach to a focus on ecosystem integrity, the WFD approach, therefore, extends its monitoring scheme to assess the overall ecological status of any water bodies.

Ukraine is not a member state of the EU and as such it is not bound by EU Water Law. However, Ukraine has indicated a desire to accede to the EU in the future and thus has taken steps towards achieving environmental acquis, and aligning its national environmental and other legislation with European Community law and more specifically European water law and policy (Moynihan and Magsig 2014). In 2004, a law was enacted on the 'State programme of adaptation of Ukraine legislation to the legislation of the European Union (Law No. 1629-IV)' which was a significant step forward for increasing the mandate for environmental alignment between EU and Ukraine (including water law). As a result, proposals were made to amend the key legal document for water management in Ukraine—the 1995 Water Code, but progress on reforming the Water Code has stalled.

Ukraine has undertaken work to begin meeting targets for water quality and monitoring under the UNECE instruments and also with a view to better future alignment with EU instruments. Three key instruments, the Ukrainian Water Code, the National Policy Programme for Water Sector Development and the Nakaz No. 56 together provide for a river basin approach that includes some measures which address water quality and monitoring but which are still lacking sufficiently detailed mechanisms to implement the broader RBM approach. Article 12 of the water code provides for the development of programmes for the protection and restoration of the water resources of the basin, but not for river basin management plans as envisaged by the EU WFD. The Nakaz No. 56 does put forward suggestions for the elaboration of river basin management plans (RBMPs) at the sub-basin level; however, it lacks concrete detail including mechanisms for implementation and objectives to be achieved, and some of the Nakaz goals are not in line with the reality of the existing legal and decision-making structure of water management in Ukraine. For example, the Nakaz suggests that river basin councils should perform a decision-making role but this is not supported by the Water Code. It is, therefore, recommended that the content of the Nakaz No. 56 be incorporated into an amended Water Code, along with additional obligations and measures on the role and function of River Basin Organizations (RBOs), the content of such RBMPs, and objectives to be achieved in line with Annex 7 of the EU WFD (Moynihan 2013). A key point to emphasize here is that through the establishment of such functioning RBMPs and RBOs that detailed requirements on monitoring, data exchange and water quality protection will be able to be better implemented.

Ukrainian legal frameworks on data monitoring and exchange stem from the Water Code (Article 21) and other regulations such as the Regulation of the Cabinet of Ministers of Ukraine of March 30 1998, No 391 'On Approval of the State System for Monitoring for the Environment'. These regulatory instruments are in need of reform and do not fully meet international and EU standards in terms of selected parameters. For example, these instruments do not include clearly defined biological parameters, defined quality targets, applied measurement and analysis methods, provision for harmonization between different measurement organizations, and they also lack mechanisms for regular and standardized internal quality management. However, the Ukraine has signaled a move towards reform with the new 2010 Law on Strategy of Environmental Policy[7] which lays down some very progressive aims and

[7] Law of Ukraine on the main principles (Strategy) of the National Environmental Policy of the Ukraine for the Period until the year 2020 of 21.12.2010 No, 2818-VI.

goals to be achieved by Ukrainian environmental policy until the year 2020, including numerous specific actions on water resources protection. These include implementing river basin management approaches, reducing water pollution through the reconstruction of existing and construction of new municipal sewage treatment facilities, ensuring compliance of drinking water quality and treatment of discharged water within established norms, ensuring centralized drinking water supply systems are in full compliance with relevant health standards and ensuring full compliance with the requirements of international treaties on the protection of transboundary watercourses and seas.[8] These are ambitious objectives and it remains to be seen how and whether such aims will be implemented and enforced.

Identification of deficits for river water quality monitoring

After having provided an overview over the legal framework for addressing water quality and monitoring, this section sheds light on the implementation and introduces ecological water quality monitoring practises in Ukraine with a specific focus on biological and hydromorphological monitoring. As a first step, the section presents general organizational structures for monitoring in Ukraine followed by a detailed analysis of the organizational and methodological approaches for biological and hydromorphological monitoring approaches. According to the National Program for Water Management Development 2002, the Ukraine aims to adopt the standards of EU WFD. Therefore, references are made to the WFD throughout the text. The second part of the sections summarizes the main shortcomings of the current monitoring system which leads to the recommendations in "Options for improved monitoring of the ecological status".

Water governance in Ukraine has been reorganized several times since independence in 1991, and is still a sector under change. The ongoing unstable political situation and frequent changes in political positions resulted in the creation of new authorities, reshuffling of positions and competencies with impact on water governance and consequently on monitoring activities. As the Mott MacDonald (2009) report states, there have been attempts to modify and specify the legal framework for RBM but these attempts have not resulted in changes in legislation or new initiatives in water management. This statement is supported by several interview partners from the water and environmental administrations as well as a consultant.

The RBM system currently in use is illustrated in Fig. 1. Five authorities, which are all state authorities and subordinated to either Ministries or Committees, are involved in collecting and processing data on water quality and quantity. They are theoretically obliged to monitor and deliver data not only to their superior authority but also to their specific River Basin Authority (RBA). RBAs are key authorities at the river basin level for the organization of RBM. They are organized under the roof of the State Agency for Water Management and are responsible for administrative tasks at the catchment scale ranging from the organization of River Basin Council (RBC) meetings, design of River Basin Management Plans (RBMP) to the preparation and publication of water quality and quantity related data of the catchment area (Hagemann and Leidel 2014). Most of these data relate to physical and chemical aspects and are collected by two state authorities: the San-Epidemiological Inspection which is subordinated to the Ministry of Health and the Ecological Inspection which is subordinated to the Ministry for Environmental Protection. The other authorities, which are listed in Fig. 1, use either process data (Environmental Administration) or they monitor other data apart from surface water quality such as the Water Resources Administration and the Hydrometeorological Inspection. However, none of these authorities collects data on biological and hydromorphological indicators even though hydromorphological data are "needed for both outlining sites at risk and preventing their deterioration and for developing and establishing river basin management strategies" (Scheifhacken et al. 2012: 1495). In the following two subsections, an overview is provided over the biological and hydromorphological monitoring practices.

Biological monitoring

In Ukraine, all biological quality elements are assessed in scientific research project contexts only, but not generally in monitoring practices. The only groups of living organisms that have been regularly assessed to date are phyto- and zooplankton while the monitoring itself does not follow a standardized sampling routine and is not always suitable for all water bodies. The fish communities are not monitored nationwide by the Ukrainian water authorities. Information on fish partly relies on private fishermen's declarations of their recent catches next to a few official statistics or own research assessments (Afanasyev et al. 2008; Bigun and Afanasyev 2010). Macrophytes and/or benthic algae are only partly assessed, depending on those water authorities with greatest staff effort and identification expertise. However, according to the WFD's recommendations, these indicators

[8] For an English summary of the 2010 Environmental Strategy Law, see the official website of the Ukrainian Parliament. http://zakon4.rada.gov.ua/laws/anot/en/2818-17. Accessed 18 January 2012.

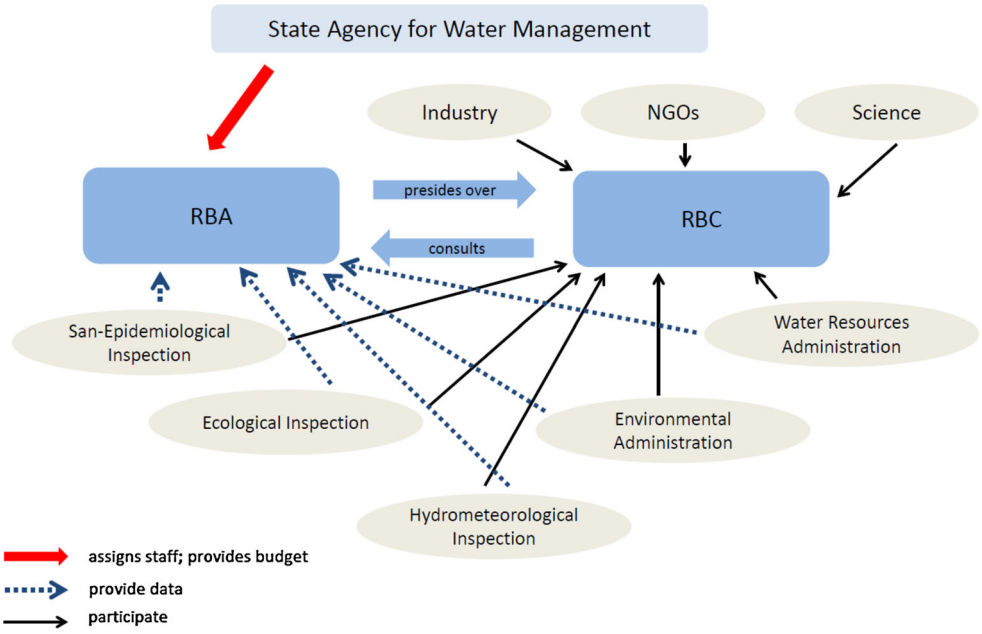

Fig. 1 Organizational structure of RBM in Ukraine. Source: Hagemann and Leidel (2014)

are rated with the lowest indication value and limited generalization range. Phytoplankton as a pollution indicator is the most extensively studied biological quality group in Ukraine (Vasenko 2005), with a long tradition in phytoplankton assessment from various habitats.

The sampling and evaluation procedures are poorly documented in Ukraine, even in scientific publications. Furthermore, methodologies are difficult to obtain even for Ukrainian authorities (interview with environmental authority and scientist). Ukrainian scientific studies use the methodologies and indices evolved in the Trent Biotic Index (TBI) developed by the Trent River Authority in England (Woodiwiss 1964) to assess the ecological state. The TBI (Woodiwiss 1964) was the basis of several indices that evolved later and has been used in European countries such as in Great Britain, France and Belgium (Metcalfe 1989). The TBI index evaluates the sensitivity to pollution of key taxa as well as the number of groups present in a sample and requests the kick-sampling of all available benthic habitats. Organisms are identified to family or genus level depending on taxa, but abundances are not enumerated (Woodiwiss 1964). Assuming the TBI demands were followed strictly, then kick-sampling of all representative habitats would be included. However, taxa abundances are not necessarily recorded or needed to calculate this index (see below, Metcalfe 1989). In contrast to other international practice, in Ukraine the occurrences of indicator species related to five water quality classes often occur in reverse order (5 high grade; 1 very low, bad grade). In addition, some general metrics, such as biomass, species, and number of rare species or diversity measures, are used. Often partly modified saprobic indices (Pantle and Buck 1955) are included in the evaluation of sites as well (Afanasyev et al. 2008).

Hydromorphological monitoring

In Ukraine, the hydromorphological regime of rivers is evaluated but does not cover the whole country. Historically, the evaluation of hydromorphology was carried out during Soviet times as far back as the 1950s and 1960s. Yet the information gathered such as statistics, maps or other information is often not available for the public and is now outdated (Scheifhacken et al. 2012). In Ukraine, primary attempts to identify the typology of water bodies and the search for reference conditions have already been done along a few river basins, e.g., 12 river types in Tisza Basin (Afanasyev et al. 2010). For the Western Bug River Basin "so far no systematic or quantitative assessment of the riverś hydromorphology exists" (Scheifhacken et al. 2012: 1485). Monitoring of hydromorphology is conducted as a by-product by RBA staff but not on a regular basis. In the context of hydromorphological assessments in Ukraine, macrophytes abundances as such are assessed as separate functional units during field surveys.

Scheifhacken et al. (2012) show in their study that methods to monitor hydromorphology in Ukraine differ only slightly from German approaches although the latter approach includes more detailed field surveys[9] . In a common field survey where both Ukrainian and German approaches were applied, the Ukrainian methods were

[9] Scheifhacken et al. (2012) in their article provide a differentiated overview over the German approaches.

better in terms of classification of water quality, but in the end both survey methodologies showed a similar gradual decrease in water quality for Ukrainian rivers (Scheifhacken et al. 2012).

Within the context of hydromorphology, the need to define reference conditions has not yet been sufficiently elaborated upon and documented (see Scheifhacken et al. 2012). But the national approaches in the EU are also not yet harmonized among member states while there is a recognized need for intercalibration (Kamp et al. 2007; Raven et al. 2002), which is complicated by different development and documentation depths in methodology. At present, the intercalibration process in the assessment of river hydromorphology is still an on-going process among EU member states. Scheifhacken et al. (2012) criticize that one of the major shortcomings of the Ukrainian criteria is that they are not appropriate for a lowland river such as the Western Bug. They further argue that other national approaches such as those methods used in the UK and Australia are more user-friendly and involve more categories.

Stressing the deficits river water quality monitoring

The description of how biological and hydromorphological monitoring is organized at present is not effective. Most importantly, biological monitoring authorities have to be assigned to carry out the monitoring and as a second step respective standards have to be set. In terms of hydromorphological monitoring, the organizational set-up is already enhanced; however, it needs to be strengthened in terms of more specific requirements and linkages of results. Furthermore, standards are also an issue that needs to be solved. Besides these specific challenges, there are other more general problems that play a role for improving monitoring of river water quality: There is also a lack of cooperation and exchange of data between most levels of water administration in Ukraine (Leidel et al. 2012). For the Western Bug River Basin, several interviewees stated that there are no real data exchange within the region and that different authorities apply different measurement techniques. In addition, data are not gathered or stored with one authority but with many different administrative authorities and units (Zingstra et al. 2009). The new Strategy Law[10] contains goals which include the development by 2015 of the state system of monitoring the environment, including improvement of the coordination between the bodies engaged in monitoring and improvement of data management systems. This presumably will contribute to closer alignment with international and EU standards, as discussed in detail above. However, one of the key issues in Ukrainian water management is the financial constraints at all levels of management and governance. This is a problem already found in other studies where one reason for the slow institutional change was often financial constraints (e.g., Pahl-Wostl et al. 2012). But as a positive sign, it can be said that the RBAs are provided with a budget which is the case also in some other transition countries such as Mongolia (Dombrowsky et al. 2014).

So far, only few scientific studies are concerned with the ecological status of Ukrainian waters (Romanenko and Yuryshynets 2006; Afanasyev et al. 2008). Three guidance documents exist that are of relevance to assess the ecological status of Ukrainian waters: the "Guidance of ecological estimation of surface waters quality on appropriate criteria" (1998); "Guidance of mapping of ecological status of surface waters of Ukraine based on water quality" (1998) and the "Guidance of determination and usage of ecological normative of surface waters quality of land and estuaries" (2001) (Romanenko and Yuryshynets 2006). However, these do not have the status of a law or regulation as they are guideline policy instruments and have not been fully implemented. The lack of monitoring has been criticized and led to field campaigns to fill at least a part of the data gap: for the Dnieper River Basin, a large transboundary river (UA, RU, BY), Vasenko (2005) criticized the general lack of stationary monitoring sites, the insufficient number of measured water quality criteria samples and analyses applied, the virtual absence of monitoring programmes as such and the lack of simultaneous surveys of biota, sediments and water quality criteria.

Options for improved monitoring of the ecological status

Based on the identified shortcomings presented in the previous section, this section discusses different options to improve monitoring of the ecological status of water bodies in Ukraine. Only very few organizational options exist to enhance monitoring. The tight state budget and the insufficient decentralization procedures impact on financial resources on all water management issues (Khmelko 2012; interviews with authorities). It restricts the establishment of a new authority and the setup of a new authority requires well-trained staff, but hydrologists in particular are rare in Ukraine (interview with consultant) and no more academic education for hydrologists in Ukraine exists. The following

[10] Law of Ukraine on the main principles (Strategy) of the National Environmental Policy of the Ukraine for the Period until the year 2020 of 21.12.2010 No, 2818-VI. For an English summary of the 2010 Environmental Strategy Law, see the official website of the Ukrainian Parliament. http://zakon4.rada.gov.ua/laws/anot/en/2818-17. Accessed 20 August 2013.

proposed options of how to deal with the monitoring challenges include:

(1) The setting up of a new authority;
(2) The integration of monitoring activities into an existing state authority; and
(3) The assignation of tasks to RBA.

However, organizational changes do not automatically solve the methodological problems and, therefore, this section will also discuss these challenges.

Organizational challenges

The organization of monitoring processes and authorities that carry out the monitoring tasks are crucial. Therefore, one key challenge in terms of monitoring is to introduce framework legislation to enhance the systematic implementation of biological and hydromorphological monitoring systems including the assignment of monitoring tasks to an existing authority or the establishment of a new authority. Therefore, different organizational options are discussed below. However, they are all regarded as short-medium term solutions that shall not replace initiatives for long-term approaches but are regarded as a first step towards improvements in monitoring.

Option 1: set-up of a new authority

Monitoring of biological and hydromorphological indicators requires specific knowledge and measures. The fact that at present no authority is in charge of monitoring these indicators that differ from procedures of monitoring of chemical and physical indicators would call for the set-up of new authorities that would take over these tasks. Only very few scientists are able to collect and analyze biological and hydromorphological data. The set-up of a new authority is not realistic at the moment given current financial constraints and because it is unclear if the authority will able to fulfill its task with the current lack of experts in Ukraine.

Option 2: integration into an existing state authority

Another option to initiate the organization and coordination of biological and hydromorphological indicator monitoring could be the integration of this task into the responsibility of an existing monitoring authority. Yet out of all authorities illustrated in Fig. 1, only the Ecological Inspection would be capable of fulfilling these tasks because they already monitor physical and chemical indicators. However, this task cannot be performed at present because the existing staff are often already under pressure (OECD 2009). Employing new staff requires financial support and sufficient training.

Option 3: tasks conducted by RBA

For all river basins across Ukraine, RBAs have been established and are equipped with a budget for human resources by the State Agency for Water Management. In the case of the RBA of the Western Bug River, they already collect data on the hydromorphology of the catchment area even though they do not cover the whole area and they do not collect data systematically.

Monitoring by RBAs would have the positive effect that the data would be directly in the hands of the RBAs. Having data collected by the RBA, it would strengthen their position and it would contribute to a rising awareness of the role of the RBAs. For biological indicators, the subject is a bit more complicated as they have so far only been assessed in scientific research project contexts, but here a knowledge transfer and training of RBA staff by scientists could be a starting point for organizing and structuring data collection and analysis. Another option could be the employment of one of the few trained scientists by the RBA. Furthermore, many Ukrainian rivers are transboundary and an exchange of experiences and information between RBAs of riparian states exists at the transboundary level especially with Poland. Here, a twinning approach, integrating experts from EU member states into the Ukrainian RBAs including training measures for Ukrainian RBA staff would be a feasible option. Another argument in favor of the RBA is that they have a direct link to the State Agency for Water Management as a coordinating authority and they receive their budget directly from them.

Finally, as already mentioned above, under the UNECE water convention Ukraine is required to establish a joint body with all riparian parties with which it shares a transboundary watercourse. Ukraine has already participated in the establishment of a very successful joint body—the International Commission for the Protection of the Danube River under the Convention on Cooperation for the Protection and Sustainable Use of the Danube River.[11] The Ukraine should work towards establishing a similar joint body for the Western Bug in order to facilitate information exchange between all three riparians. Ukraine should also take full advantage of the numerous opportunities for legislative support and technical exchange on transboundary issues including water quality and monitoring, which are organized and facilitated by the institutional platform of the UNECE Convention.

Methodological challenges

"Identification of deficits for river water quality monitoring" of this paper showed that reforms are necessary regarding biological and hydromorphological monitoring.

[11] (Adopted 29 June 1994, entered into force 22 October 1998).

In terms of the latter, amendments and specifications of the existing regulations are required, whereas for the biological monitoring, comprehensive methodologies are to be designed. However, the options to introduce new and innovative approaches are often limited due to a lack of budget. Mott MacDonald (2009) showed that even though the willingness to introduce improved standards is obvious, resources for water management are very limited and Ukraine often depends on external project support.

Interviewees from different state authorities report that monitoring deficits exist such as incoherent data collection caused by different calibration methods that hinder the comparability of data. In addition, different authorities—namely the regional branches of the state administrations of the Ministry for Environmental Protection and the Ministry of Health—analyze data separately with different methods. State administrations sample and process data only partially and transfer them to their subordinated administration in Kiev, because the responsibility of data evaluation and site classification is done there. Data processing and storage are limited to basic statistical analyses only. Simple interpretation of results is common and then presented to the monitoring institution without original data; therefore, the analysis of the original data is not possible (interview Hydrometeorological Inspection).

As introduced in "Biological monitoring", the TBI represents an outdated concept which is still the present concept applied in Ukrainian studies. According to a member of the National Academy of Science, an adaptation of the present Ukrainian system to the rather complex approach of international approaches is processed (interview scientist, Afanasyev et al. 2010). In the western part of Ukraine, cross border cooperation can help to approach such challenges. In the Western Bug River Basin and the Tisza River Basin close contacts with Poland, Hungary and Romania have been established and lessons can be learnt here. The EU WFD defined some indicators for biological monitoring that are most suitable for analysis such as benthic macroinvertebrates, fish and partly benthic algae, in contrast to macrophytes (dependent on hydrology) or phytoplankton with more limited application range. In the framework of the European Neighborhood Policy, technical and administrative support can be provided to adopt those indicators. In terms of technical equipment, several people interviewed stated that they received support from different projects such as the TACIS project in the Western Bug River Basin in terms of technical equipment, otherwise the budget for investment is very limited.

Besides the issues of standardization, recording of sampling and evaluation procedures has to be dealt with. As the amount of gauges is crucial, they have to be identified. Interviewees from the Hydrometeorological Inspection stated that in their field the amount of gauges is too low; however, due to the lack of capacities no further monitoring sites can be established. Initiatives to increase the amount of sites have to come from the State Agency for Water Management as the leading authority based on sound scientific investigations and findings. Additionally, they have to set the timetable for the identification and deadline of milestones.

Discussion

The outline of the three different options showed that the questions of organization and definition of methodologies are of the same importance—both have to be addressed adequately to achieve a better monitoring. From the analysis, it becomes clear that the RBA as the authority to take over certain monitoring tasks has advantages. For the RBA, it seems logical that they take over the task of monitoring the hydromorphological indicators themselves, because they do it already and they have the knowledge and they are better equipped in terms of financial resources. However, monitoring of biological indicators would be more complex because the RBA staff in Ukraine is not prepared for such tasks. An advantage would be that data are with the RBA where they are comparatively examined and sent directly to the State Agency for Water Management. As a consequence, the State Agency could better fulfill its role as a coordination body between the different river basins. Also problems of standardization could be directly fed back from the State Agency for Water Management to other RBAs. Furthermore, requirements for education on water management issues can be transferred from the Water Agency to the respective ministries.

The up-take of the monitoring tasks by the RBA might seem to be unusual from an EU perspective and not in line with the WFD. In Germany, for example, the RBAs do not have management functions and many tasks are performed by existing authorities at level of federal states. RBAs have a coordination function but in Ukraine the RBAs are designed to take over management tasks. As such, the assignment of monitoring tasks seems to be feasible theoretically, especially given the financial constraints on other authorities. Taking into account the fact that it is at the moment not foreseeable whether at all Ukraine will become an EU member state it can be expected that they will, therefore, not fully adapt their legislation to EU law. From a long-term perspective, a respective authority for monitoring is required to fulfill national and international requirements but at present the financial and political situation does not allow for such endeavors and a first step in taking up the task of biological and hydromorphological indicator monitoring by RBAs could raise awareness and might foster the training of specialists.

Harmonization of hydromorphological standards could also be well integrated in the RBA authorities as these data are already monitored at the river basin scale. The establishment of a common standard for all river basins across Ukraine could also be a task for the RBA in collaboration with the State Agency for Water Management and it would be supported by the EU. Where river basins are transboundary and most of the Ukrainian basins are, contacts with neighboring countries already exist through cooperation at the river basin level. Here, the RBAs are the partners and as such can directly exchange information on standard setting and harmonization.

However, when looking at the implementation procedure and problems with the WFD (Bathe et al. 2011, 2013), it should be kept in mind that the process of standard setting and harmonization is still an ongoing process in the EU and that, therefore, the lack of development in Ukraine is not unusual, but at least steps of awareness raising and initiatives to start the process of monitoring should be taken. At present, budget and qualified staff are major challenges but with the option to provisionally introduce these tasks with the RBA at least the financial argument becomes less valid. For a permanent solution, long-term programmes have to be set-up such as the establishment of training programmes for example at Universities that already have a strong water focus.

Conclusions

The paper demonstrated that Ukraine has significant work to do to improve its water quality and monitoring procedures and to align with international and national requirements. At present, there is a lack of coordination and organization of monitoring ecological indicators in Ukraine, especially in biological and hydromorphological fields. To solve the problem of the lack of monitoring in the short term, Ukraine has already established RBAs that conduct monitoring tasks for hydromorphology of river water bodies. Their advantage is that they are already equipped with a budget and they have a direct link with the State Agency for Water Management. As the State Agency would be the authority to define and set standards for water quality monitoring, this close link can be helpful for implementing such standards. Furthermore, the State Agency would have direct access to the data and would not have to ask other Ministries for such data.

However, in the long term, the State Agency must define strategies as to how ecological water monitoring should be conducted, who should be responsible, what should be included in such measures and how additional costs are to be covered. In this regard, the following actions are required:

(1) define tasks that are in line with international water governance requirements,
(2) define authorities and their tasks and
(3) implement legislation that ensures the enforcement of the first two aspects.

The current political upheaval in Ukraine may open certain windows of opportunities for institutional changes as observed in Germany after the reunification (Klauer et al. 2013a, b). To support such developments twinning projects, assistance from international organizations through the framework of the European Neighborhood programme and greater engagement with the UNECE institutional exchange platform could help to improve structures for water governance. The cooperation between national and international scientists and the integration of their knowledge into policy processes have been started and results are promising. Yet, it should be extended further because scientists have the knowledge administrations require and the administrations have the means to distribute this information in a way that is more publicly accessible. Strengthening this knowledge chain will be critical to stimulating a behavior shift that is needed for more sustainable future water management in the Ukraine.

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