OVERVIEW OF SURFACE WATER QUALITY MONITORING STATUS IN THE FRAME OF EU WATER FRAMEWORK DIRECTIVE REQUIREMENT IN SOME ALBANIAN RIVERS

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Abstract: *This paper first reviews the principal monitoring requirements of the WFD and discusses the monitoring network for diffuse pollution in Albania in the context of implementation of the EU Water Framework Directive (WFD). Considerations on water quality of surface waters from main Albanian rivers based on ecological and chemicals indicators are reported. Quality measurement are essential to demonstrate the comparability of obtained data and they form the basis for correct decisions related to management of water resources. The existing surface water quality monitoring network provides only restricted information to select between different management options when implementing river basin management plans (RBMP) under the WFD. We then clearly define and exemplify the roles, the functions and the need for a new set of monitoring tools support of implementing the WFD, using the case studies based on datasets that we obtained during recurrent monitoring campaigns in the Rivers Ishmi, Erzeni, Shkumbini and Mati.*

Keywords: *Water quality, EU Water Framework Directive, Monitoring acquis.*

1. INTRODUCTION

The WFD requires that appropriate water quality monitoring networks are established and maintained (Directive 2000/60/EC, Annexes V, VI). Prior to establishing a monitoring network and programme the major surface waters have to be characterised as background for establishing at least good environmental status for surface water bodies or good quantitative and chemical status for ground water. The monitoring networks for surface waters should address:

- Flow measurements to monitor the quantitative status of the water body,
- Analysis of physical and chemical status of the water with respect to the quality objectives as determined by the specific category of classification of the water body,
- Analysis of ecological parameters in order to assess the ecological status and the ecological potential.

Monitoring systems include surveillance, operational, and investigative monitoring (Directive 2000/60/EC; Annexes V, VI):

- Surveillance monitoring shall be done to provide an overall assessment of the existing surface water and groundwater status and with the purpose to reveal the long-term developmental trends in water status.
- Operational monitoring is applied in water bodies at risk of not achieving good ecological status when a programme of measures has been implemented. The role of operational monitoring is to evaluate whether implemented measures are sufficient or whether additional measures are needed. As no programme of measures has been implemented so far within Albanian rivers no additional operational monitoring is needed. In the op-

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erational monitoring may include the meteorological monitoring and warning, as very important for the River Basin Management.
- Investigative monitoring is used to find out the reason why a water body does not fulfil requirements of good environmental status or in case monitoring data is missing to find out what the status of a water body actually is. There has not been established investigative monitoring programmes in rivers, lagoons or coastal waters at the moment in Albania.

The current water quality monitoring programmes in Albania are relatively extensive (NEA, 2015, 2016, 2017, 2018). These cover the main rivers (Drini, Mati, Ishmi, Erzeni, Shkumbini, Semani, Vjosa), the natural lakes of Ohrid, Prespa and Shkodra and include most of the polluted areas and environmental "hot spots". The physic-chemical characteristics measured at selected monitoring stations by responsible authorities are confined to basic water quality and nutrient parameters with limited measurements of heavy metals, organics, priority substances and hazardous substances.

Available monitoring data and assessment criteria do not yet allow for a comprehensive assessment of the environmental state of water bodies. Generally, most of the rivers are polluted in their middle/lower reaches, largely due to the discharges of treated and untreated wastewater. This implies that those river sections will not comply with the WFD criteria for „good" status.

The purpose of this article is to provide an overview of the current situation of water monitoring in Albania, while identifying the issues and main shortcomings, and to propose a set of recommendations on how to improve the Albanian system meeting the EU requirements and standards.

2. METHODOLOGY

This study is based on the desk research; reaching and collecting all existing information, studies, reports in relation to surface water quality monitoring. The assessment has been carried out considering the institutional monitoring arrangement as well in Albania and its respective periodical reporting on environmental status of water quality in Albania.

The study comprises the following phases:
- Emphasize the EU Water Framework Directive requirements related to monitoring system with particular focus to surface water quality monitoring,
- Collection of all existing studies, documents, technical reports, projects outputs, data series related to surface water quality assessment,
- Comparison of monitoring results and monitoring methods in compliance with EU Water Framework Directive monitoring requirements,
- Defining gaps and needs at the surface water quality monitoring system in Albania and provide the appropriate recommendations according to EU WFD.

3. RESULTS AND DISCUSSION

The National Environmental Agency is the water monitoring authority in Albania; the NEA routinely monitors four times per year the basic physico-chemical parameters, heavy metals, organochlorine pesticides and polycyclic aromatic hydrocarbons in the main rivers of Albania at 34 sites. The network includes the basin of Drin, Mat, Erzen-Ishëm, Shkumbin, Seman, and Vjosa.

In 2019, the following parameters were sampled and analyzed four times per year (once per season): water temperature, pH, alkalinity, salinity, electric conductivity, dissolved oxygen, chemical oxygen demand (COD, dichromate method), biochemical oxygen demand (BOD5), nitrite (NO2), nitrate (NO3), total ammonium (NH4), total phosphorus (Ptotal), orthophosphate (PO4) and suspended solids and transparency (lakes only). The NEA's laboratory is ISO accredited for the aforementioned parameters. They are significant parameters supporting biological quality elements, which, furthermore, can be linked with primary sources of pollution, such as discharges of untreated and treated wastewater. Table 1 provides the scheme for classification of the physico-chemical quality of rivers applied in Albania. The EU Water Framework Directive (WFD) priority substances and biological quality elements (benthic invertebrate fauna, phytoplankton, Phyto benthos, macrophytes and fish) are not yet routinely monitored.

Some of the Biological parameters are mainly monitored by universities; NEA has the necessary equipment and capacity to monitor the macroinvertebrates only. Until now NEA has carried out biological monitoring for Shkumbini River under the support of EU funded Project (EuropeAid/135700/DH/SER/AL; Keci E. 2015; Keci et al. 2020).

Table 1. Classification scheme for assessment of physico-chemical parameters in rivers

Parameters	Unit	Parameter limit values				
		High Status (I)	Good Status (II)	Moderate Status (III)	Poor Status (IV)	Bad Status (V)
Dissolved O_2	mg/l	>7	>6	>5	>4	<3
BOD_5	mg/l	< 2	< 3,5	< 7	< 18	> 18
pH (acid)			> 6,5	> 6		
pH (alkaline)			< 8,5	< 9		
NH_4	mg/l	<0,05	<0,3	<0,6	<1,5	>1,5
NO_2	mg/l	<0,01	<0,06	<0,12	<0,3	>0,3
NO_3	mg/l	<0,8	<2	<4	<10	>10
PO_4	mg/l	<0,05	<0,10	<0,2	0,5	>0,5
Total-P	mg/l	<0,1	<0,20	<0,4	<1	>1

Source: NEA, 2015, 2016, 2017, 2018

This classification – although distinguishing five classes, labelled from „high" to „bad" – is not yet designed fully in accordance with the requirements of the WFD.

Establishing schemes for the classification of ecological status requires many field data, which are currently not available.

Table 2 indicates that parts of the river basins did not meet the Albanian thresholds for „Good" status for physico-chemical parameters, notably in the lower reaches of the rivers.

Shkumbini River

The available measurements data shows values that are below the border limits between moderate and good chemical status and there are no developmental trends indicating that the chemical status in the river system is deteriorating upstream the Rrogozhina monitoring station. Therefore, there are no indication that good chemical status in Shkumbini River cannot be achieved upstream the Rrogozhine monitoring station.

Mati and Erzeni Rivers

Table 2 shows a good water quality for the monitoring stations of Mati and Erzeni Rivers. However, the monitoring parameters analyzed commonly in Albania are quite limited and not sufficient for the definition of quality ecological status of a water body.

Ishmi River

The parameters taken into consideration in Table 2, even though limited, indicate a bad water quality in Ishmi River with high pollution in the monitoring stations.

Table 2. Water quality status in some of the Albanian Rivers s

River	Monitoring Station	Average		
		$BOD_5(O_2)$ mg/l	NH_4 mg/l	Tot-P mg/l
Mati	Little Fani, Kresheni – in the Little Fani river at the bridge Kresheni-Gjegjani & Kukesi.	I	II	I
	Mati (Ma), Miloti – in Mati river (Miloti), at the new bridge Tirana-Shkodra (Berluskoni bridge in Shënkoll village).	I	II	I
	Mati (Ma), Klosi (Burreli) – in Mati river (Burreli), at the bridge connecting Klosi with Darse village	I	II	I
	Big Fani (Fa), Kresheni – In the Big Fani river, between the two bridges Miloti-Kukesi and Miloti-Kresheni.	I	II	I
Shkumbini	Shkumbini (Sh), Qukesi (Prrenjasi) – in Shkumini river, at about 500 m upstream of Qukesi village	I	I	I
	Shkumbini (Sh), Librazhdi downstream – in Shkumbini river, at the railway bridge, about 4 km downstream Librazhdi, after the confluence with Rrapuni river.	II	I	I
	Shkumbini (Sh), Metalurgjiku (Elbasani) – in Shkumbini river, at about 6 km downstream Toplia Bridge at the southwestern part of the Elbasani Town.	II	I	II
	Shkumbini (Sh), Papri (Cerriku) – in Shkumbini river, at the Papri bridge in Shkumbini	II	II	I
	Shkumbini (Sh), Rrogozhina – in Shkumbini river, at the Rrogozhina bridge (the national road Kavaja-Lushnja).	III	II	I
Ishem	Lana/Rinas Bridge, rocky substrate with medium/low flow rate, bushy and grassy riparian vegetation; far from the inhabited areas	V	IV	V
	Zeze/FusheKruje, rocky substrate with medium/low flow rate; no vegetation; the station situated in an inhabited area surrounded by houses in both sides of the river.	V	IV	IV
	Gjuricaj, sludge/gravel substrate with medium flow rate; high, bushy and grassy riparian vegetation; the station is situated in an inhabited area close to the river delta.	V	V	V
Erzen	Pellumbas, rocky substrate with medium flow rate, bushy vegetation, situated 2km from Pellumbas village	I	II	I
	Beshiri Bridge, Ndroq, rocky/gravel substrate with medium flow rate; grassy vegetation; situated in the inhabited area	I	II	I
	Sollomone, Fshati Rinia, sludge/gravel substrate, with medium/ low flow rate, high, bushy and grassy vegetation, situated within the inhabited area.	II	I	I

Source: NEA, 2018; Keci et al., 2020; Keci et al., 2018; EEA, 2008

In general, the monitoring of surface water quality in Albania is not performed in fully compliance with the Water Framework Directive. Assessment of ecological status is arguably the most complicated challenge for surface water monitoring programmes.

The preparation of the first generation of river basin management plans (RBMPs) – including characterization of surface water body types in accordance with Annex II of the WFD – is revealing that the following main aspects should be taken into account for improving the performance and fulfilling the gaps in water monitoring.

More than 34 monitoring sites will be needed for the preparation and implementation of RBMPs.

According to WFD (Article 5, Article 6, Annex II, Annex III), characterization of each river basin district has to be carried out in terms of pressures, impacts and economics of water uses. This process has not been done in fully compliance with the WFD, except for the rivers that has been gone through the preparation of River Basin Management Plans. Currently Mati River MP prepared through EU funded project drafted in 2011, needs to be updated. For Shkumbini River Basin has been drafted an Adaptation Plan to Clime changes, which is a good basis for a Management Plan. Erzen and Ishem River basins have not yet a Management Plan.

Inter-calibration of the ecological status classification systems for the above rivers has not been carried out according to Article 2 (22), Annex V of WFD.

The monitoring network prepared by NEA refers to a limited number of monitoring stations not based to the water body delineation. According to Water Framework Directive, each water body delineated should be periodically monitored.

Currently, only basic physico-chemical parameters are routinely monitored four times per year (once per season) – at 34 sites in 2019. Monitoring four times per year may not be sufficient for capturing the dynamics of river water quality and determining trends, notably for seasonally varying parameters; at least monthly sampling should prevail.

Parameters such as water temperature, dissolved oxygen, BOD5, NH4, NO3, NO2, PO4 and Ptotal although relevant as be linked with primary sources of pollution, such as discharges of untreated and treated wastewater, would need to be integrated with biological quality elements, such as benthic invertebrate fauna, phytoplankton, Phyto benthos, macrophytes and fish, which are not included in standard programmes of surveillance monitoring in rivers. Biological index values are to a higher degree indicator of seasonal trends in contrast to monitoring of chemical parameters which only expresses the instantaneous status in a water sample. In consequence monitoring of biological indices can justify less frequent and more relevant monitoring.

On the other hand, definition of ecological status requires minimum 5 years of successive monitoring of a water body. The monitoring in Albania appears to be fragmentary and not completed, mainly depending on the related projects that support the national monitoring, technically and financially.

As of early 2018, the NEA laboratory is having its equipment (atomic absorption spectrometer – AAS, and gas chromatograph/mass spectrometer – GC/MS) prepared and its methods under

accreditation for analysis of a selected number of WFD priority substances: heavy metals, organochlorine pesticides and polycyclic aromatic hydrocarbons. However, the analysis of priority substances is expensive, while the NEA already has difficulties financing water monitoring in the framework of the current monitoring programmes.

Challenging aspect of all three of the assessment approaches is the need to establish a benchmark, reference condition to anchor judgments of change (that needs to be used in the calculation of ecological quality ratios of observed and expected condition) (WFD, Annex 5, section 1.2). There is no methodology set and thus no reference conditions have been defined for any of the Albanian Rivers.

One weakness of the existing monitoring procedures is that the water flow is not monitored. For monitoring of hydrology and the quantitative status of water in rivers any measurements should be accompanied with sampling for monitoring of chemical parameters and vice versa. Hydrometric monitoring in combination with monitoring of chemical parameters will facilitate calculations of transport of chemical elements as background for making load estimates within sub-basins. At the same time misinterpretation of levels of concentrations of chemical components as a consequence of shifting water levels and flows and dilution effects may be avoided. Based on these assumptions hydrological surveillance monitoring is proposed to take place at the existing hydrometric monitoring stations simultaneously with sampling for measurements of chemical parameters.

CONCLUSION

Assessment of ecological status is arguably the most complicated challenge of surface water monitoring programmes. Since Albania has to start from scratch, establishing WFD-compliant schemes for (type-specific) classification of the ecological status of surface water bodies requires substantial technical and financial support, an adequate and modern laboratory infrastructure, a fully functional monitoring network, as well as cooperation of all institutions responsible for water resources management, so as to eliminate overlapped responsibilities and reach the required transparency in both financial and technical terms.

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