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Pro*f*test
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Development cooperation: Quality control in environmental analysis – Case study from Kyrgyz Republic

The quality control issues are facing increasing importance and interest within the development cooperation projects focusing on the strengthening the environmental management. SYKE is participating in the capacity building project to adopt broadly recognized good practices to carry out water quality monitoring for water management in the Kyrgyz Republic (Fig 1).

Proficiency tests

EMA laboratory participated in two proficiency tests (PT) organized by Proftest SYKE. At first EMA tested only the synthetic samples (PT 2/2013, Natural water concentration). The results indicated methodological problems and no satisfactory results were gained (Table 1).

In the second PT (10/2013, Waste water concentration), both synthetic samples as well as municipal waste water samples were tested. The synthetic samples showed improved methodology (N_{NH4} and $N_{NO2+NO3}$), which lead also to good performance with the waste water sample (N_{NH4}). The matrix effect was affecting to the measurement of $N_{NO2+NO3}$ from waste water sample. For chloride, the synthetic sample with high concentration indicated methodological problems, but the laboratory's performance with the waste water sample was satisfactory. The synthetic sample for sulphate indicated good methodology, while the waste water sample showed that the matrix effect was not thoroughly taken into account. Also other parameters were analysed, which results could be used to further improve the methodology (Table 1).

Comparison study I

The comparison study between SYKE and EMA laboratories was organized for the analysis of ammonium nitrogen (N_{NH4}), nitrate nitrogen (N_{NO3}) and nitrite nitrogen (N_{NO2}) in water samples (Table 2). The synthetic water samples were prepared by diluting NIST traceable certified reference materials produced by Merck KGaA. Both laboratories measured the samples on the same day. The calculated NIST traceable concentrations were used as the assigned values for all measurements. The uncertainties of the assigned values were < 1%. Most of the results from both laboratories (83%) were satisfactory. Here only the ammonium nitrogen result of EMA laboratory was unsatisfactory.

Comparison study II

The first joint monitoring of the River Kara-Balta and the transboundary River Chu was conducted together with SYKE, EMA and Kyrgyz Hydromet laboratories. This first sampling comparison study was organized to combine and enhance the sampling procedures. Further, the samples were analysed in all three laboratories for several parameters, but no synthetic samples were analysed, thus no reference values were set (eg. SO_4 in Figure 2). The nutrient analyses indicated some methodological problems (high LODs and non-consistent results) whereas chloride analyses showed promising consistency between the Kyrgyz laboratories, and the results are mainly within ±20% from the SYKE value.
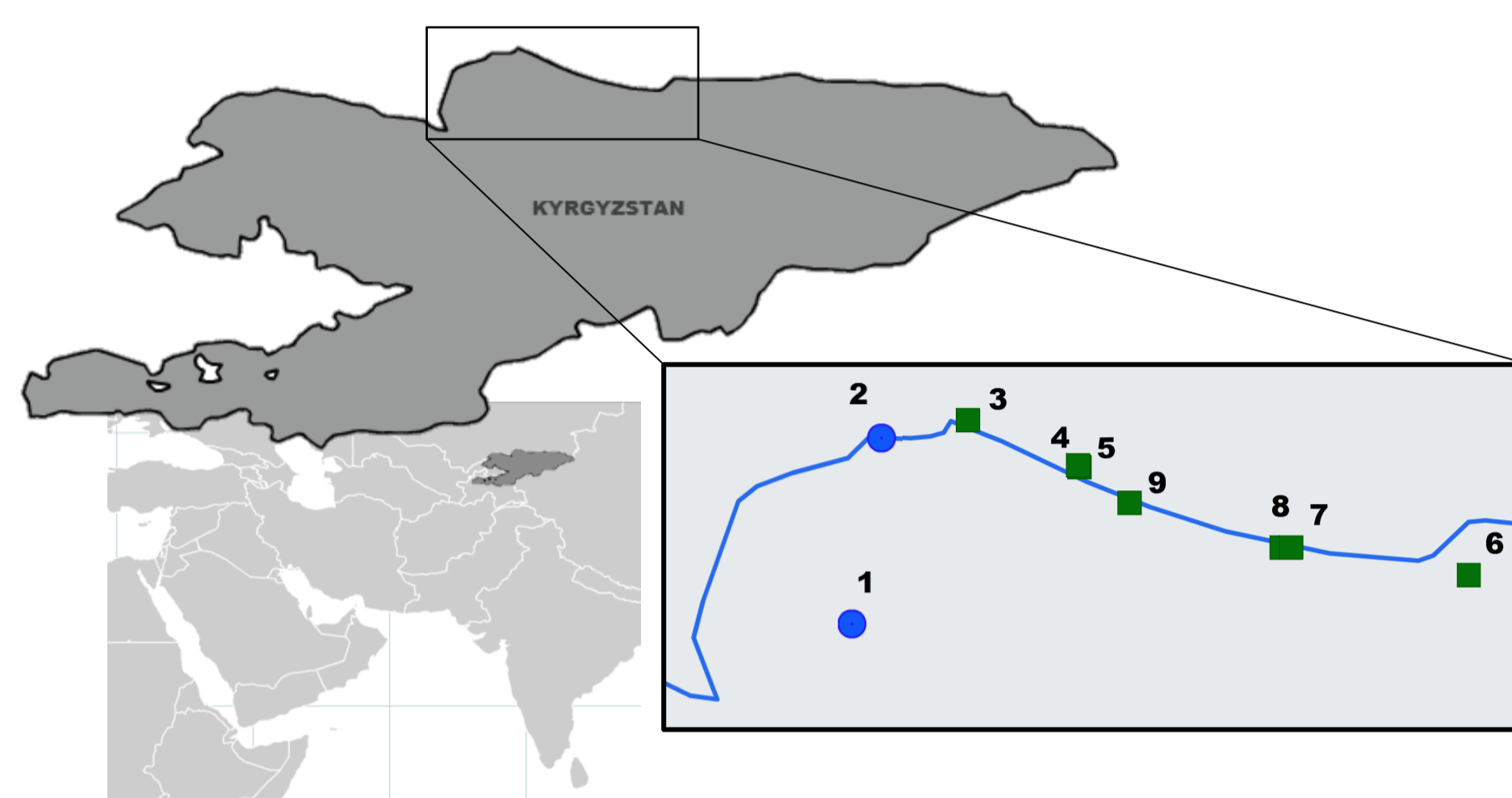

Figure 1: Kyrgyz Republic.
The sampling points, blue dots for Kara-Balta River, green squares for Chu River.

Table 1: EMA laboratory results from two PTs in 2013.

Analyte, unit	No of the PT round	Sample	z score[1]	Assigned value	Lab's result
N_{NH4} [mg/l]	PT 2	Synthetic	**-3,18**	0,0591	0,045
	PT 10	Synthetic	-1,00	0,863	0,82
	PT 10	Municipal effluent	0,77	1,22	1,29
$N_{NO2+NO3}$ [mg/l]	PT 2	Synthetic	**104**	0,0774	0,400
	PT 10	Synthetic	-1,25	1	0,95
	PT 10	Municipal effluent	**-4,15**	12,6	10,51
pH	PT 2	Synthetic	*-2,46*	7,25	7,0
Cl [mg/l]	PT 10	Synthetic	**188**	46,76	485,5
	PT 10	Municipal effluent	0,51	97,5	100,0
SO_4 [mg/l]	PT 10	Synthetic	-1,74	35,04	32,0
	PT 10	Municipal effluent	*-2,61*	119	103,5

Table 2: Results from the comparison study in September 2013.

Analyte	Assigned value	SYKE Laboratory		EMA Laboratory	
		Result	z score	Result	z score[1]
N_{NH4} [mg/l]	0,132	0,131	-0,15	0,105	**-4,09**
N_{NO3} [mg/l]	1,24	1,236	-0,06	1,35	1,77
N_{NO2} [mg/l]	0,052	0,052	0,00	0,05	-0,77

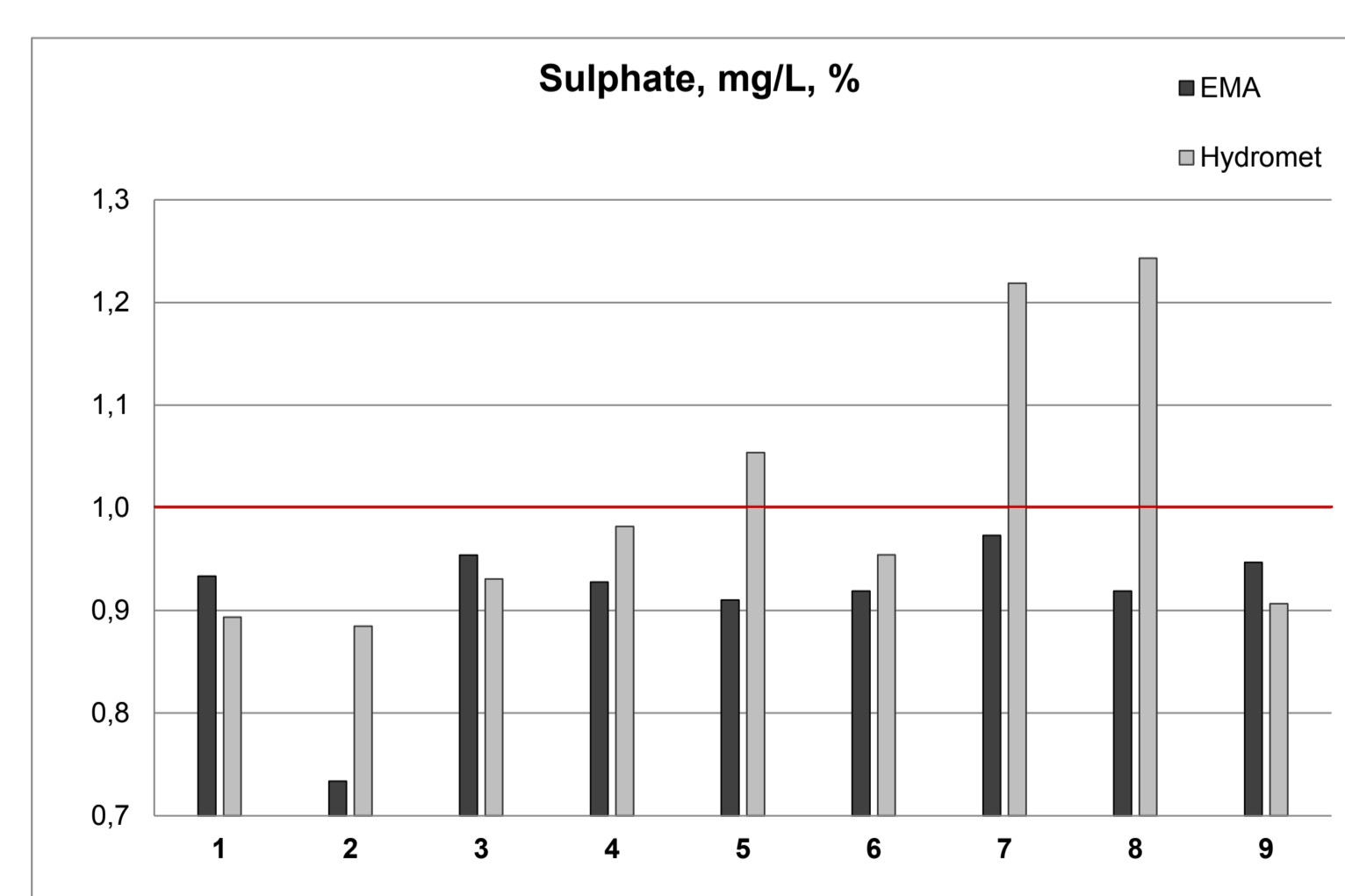[1] Satisfactory, *Questionable*, **Unsatisfactory**

Figure 2: Comparison between three laboratories participating in the sampling comparison in April 2014. The results from SYKE are adjusted to 1,0 (red line in the figure) and the calculated percentual difference from that for both Kyrgyz laboratories. Numbers indicate the sampling points, see Figure 1. 89% of the results by EMA are less than 10% lower than the SYKE value, those being consistently lower when compared to SYKE values. 56% of the Kyrgyz Hydromet results are within ±10% from the SYKE value. The sampling point 2 has a very high SO_4 concentrations when compared to the other sampling points.

Participating Organizations

SYKE
Finnish Environment Institute

EMA laboratory
Ecological Monitoring Administration (EMA) laboratory of the State Agency on Environment Protection and Forestry (SAEPF) under the Government of the Kyrgyz Republic

Kyrgyz Hydromet
State Agency on Hydrometeorology under the Ministry of Emergency Situations of Kyrgyz Republic

Conclusions

- The methodology for N_{NH4} and $N_{NO2+NO3}$ has been enhanced in the EMA laboratory with the help of the participation to the proficiency testing.

- The comparison studies have been producing valuable information when strengthening the performance, both on sampling procedures as well as laboratory analysis.

- Strengthening the within-country co-operation is the key issue for the national laboratory networking, especially within the developing areas.

- Shortage in instrumentation and know-how is setting limits for the possible parameters of analysis, thus more international co-operation is needed for the institutional capacity building.

- Further development in quality control issues is needed and participation to the future proficiency tests strongly encouraged.