EU4Environment in Eastern Partner Countries:
Water Resources and Environmental Data (ENI/2021/425-550)

TRANSBOUNDARY SURFACE WATER SURVEY AZERBAIJAN – GEORGIA 2023

Contract-No: 20940-C1/GE-NEA-2023/9
20940-C1/AZ-AzelabLLC-2023/6

Funded by the European Union

EU4Environment
Water and Data in Eastern Partner Countries

TRANSBOUNDARY SURFACE WATER SURVEY AZERBAIJAN – GEORGIA 2023

Contract-No: 20940-C1/GE-NEA-2023/9
20940-C1/AZ-AzelabLLC-2023/6

Funded by the European Union

EU4Environment
Water and Data in Eastern Partner Countries

EU4Environment in Eastern Partner Countries:
Water Resources and Environmental Data (ENI/2021/425-550)

ABOUT THIS REPORT

AUTHORS(S)

AZERBAIJAN

AZELAB LLC

Ramina Abdullayeva, Gulgaz Huseynova, Ilaha Gurbanova

NATIONAL HYDROMETEOROLOGICAL SERVICE

Gulnara Abbasova, Vafadar İsmayilov

GEORGIA

NATIONAL ENVIRONMENTAL AGENCY, GEORGIA

Pollution Monitoring Department
Gela Sandodze, Lia Aptsiauri, Gulchina Kuchava, Irakli Kordzaia, Ana Gabrichidze

Hydromet Department
Giorgi Guliashvili, Ioseb Kinkladze

REVIEWERS

EU4ENVIRONMENT WATER&DATA

Umweltbundesamt GmbH (AT)

Daniel Trauner

DISCLAIMER

IMPRINT

Owner and Editor: EU4Environment-Water and Data Consortium

Umweltbundesamt GmbH	Office International de l'Eau (IOW)
Spittelauer Lände 5	21/23 rue de Madrid
1090 Vienna, Austria	75008 Paris, FRANCE

November 2024

ABOUT EU4ENVIRONMENT – WATER RESOURCES AND ENVIRONMENTAL DATA

This Programme aims at improving people's wellbeing in EU's Eastern Partner Countries and enabling their green transformation in line with the European Green Deal and the Sustainable Development Goals (SDGs). The programme's activities are clustered around two specific objectives: 1) support a more sustainable use of water resources and 2) improve the use of sound environmental data and their availability for policy-makers and citizens. It ensures continuity of the Shared Environmental Information System Phase II and the EU Water Initiative Plus for Eastern Partnership programmes.

The Programme is implemented by five Partner organisations: Environment Agency Austria (UBA), Austrian Development Agency (ADA), International Office for Water (OiEau) (France), Organisation for Economic Co-operation and Development (OECD), United Nations Economic Commission for Europe (UNECE). The action is co-funded by the European Union, the Austrian Development Cooperation and the French Artois-Picardie Water Agency based on a budget of EUR 12,75 million (EUR 12 million EU contribution). The implementation period is 2021-2024.

https://eu4waterdata.eu

CONTENTS

LIST OF TABLES

LIST OF FIGURES

List of abbreviations

ADA..... Austrian Development Agency

BQE ..... Biological Quality Elements

EU ..... European Union

EU4EnvWD..... EU4Environment in Eastern Partner Countries:
Water Resources and Environmental Data

IOW/OIEau..... International Office for Water, France

RBMP ..... River Basin Management Plan

Reps ..... Representatives (the local project staff in each country)

UBA..... Umweltbundesamt GmbH, Environment Agency Austria

WFD ..... Water Framework Directive

LLC.....Limited Liability Company

Country Specific Abbreviations Azerbaijan

MENR..... Ministry of Ecology and Natural Resources

NHS ..... National Hydrometeorological Service

Country Specific Abbreviations Georgia

MENRP..... Ministry of Environment and Natural Resources Protection

NEA ..... National Environment Agency

NWP..... National Water Partnership

Executive Summary

This report presents and discusses the results of the transboundary surface water survey between Azerbaijan and Georgia conducted in October 2023 at selected sites in the Alazani/Ganikh[1] river basin (9 sites in Azerbaijan, 7 in Georgia). The implementing institutions were the National Environment Agency of Georgia (NEA), the National Hydrometrological Service (NHS) of Azerbaijan, and Azelab LLC. The survey was remotely supervised by international experts of the EU4Environment Water & Data programme. The investigation included chemical, biological, and hydro-morphological parameters with the aim to compare and harmonize the sampling, analyzing, and reporting routines of both participating institutions.

The results show that further coordination between the two laboratories is required. Possible reasons for the discrepancies in the results are discussed in this report. Recommendations are given on how both institutions should work closely together to identify sources of errors, harmonize methods, and improve the comparability of the results in the future.

Chemical analyses reach comparable values for a part of the investigated parameters, while others differ significantly. A surprising result was the extremely low number of individuals and taxa of benthic invertebrates sampled during the survey by both sides, which lowers the validity and significance of the biological data. It is recommended to repeat this transboundary exercise in the future with a more direct interaction and cooperation of the sampling and laboratory teams to mitigate possible different methodological approaches. Further, future sampling campaigns should be conducted in late spring in order to investigate if the biological results are related to seasonal changes.

[1] Alazani (Georgian) or Ganikh (Azeri). This report will use “Alazani/Ganikh” for overall descriptions and country specific names when appropriate’.

1. Introduction and Scope

In the scope of implementing the EU4Environment Water & Data programme, both national and transboundary surface surveys are being conducted with a focus on the Caucasus countries of the EU Eastern Partner region.

In October 2023, the National Environment Agency of Georgia (NEA), the National Hydrometrological Service (NHS) of Azerbaijan, and Azelab LLC conducted a Transboundary Surface Water Survey in the Alazani/Ganikh river basin. The Georgian team investigated 7 sites, while the Azeri team opted to sample at 9 sites during this survey (see Table 2 and Table 3). It was not possible for both teams to cross national borders and take samples jointly. For that reason, of each team included 4 sites in their sampling campaign on the border river Alazani/Ganikh which were sampled at the same location and time, but on the opposite sites of the river to increase the comparability of the results.

Table 1: Overview Transboundary Survey

Country	Azbaijan and Georgia
River basin	Alazani/Ganikh; Transboundary region between Azerbaijan and Georgia
Campaign [1)]	Autumn, October 2023
Objective	• Collecting environmental data in the border region between Azerbaijan and Georgia • methodological basis for future monitoring programs • Comparing sampling methods, lab work, and results of AzeLab LLC (AZ), NHS (AZ) and NEA (GE).
Quality elements	Biological quality components: • Macrozoobenthos • Phytobenthos (Was only collected as an exercise, not assessed) Supporting elements: • Hydro-morphological site desription • General physico-chemical quality elements
Preparation of field work	20-22 October 2023
Field work	GE: 23-25 October 2023 AZ: 23-27 October 2023

2. GENERAL DESCRIPTION OF THE SURVEY

2.1. Selected river basin, sampling sites, sampling period

Exact locations of the sampling sites were discussed by the project staff and appropriate units of MEPA, NEA (Water Management and Pollution Monitoring) of Georgia and National Hydrometrological Service (NHS) of Azerbaijan. The sampling by the Georgian team was carried out during 23-25 October 2023 and by the Azeri Team during 23-27 October.

The survey included the following activities:

- Sampling of surface water at a total of 16 sampling sites (7 in GE, 9 in AZ)
- Analysis of general physico-chemical parameters
- Sampling and analysis of benthic invertebrates
- Hydromorphology
- Field protocol and site description
- Reporting

A detailed list of sampling sites and their description are listed in Table 3. Figure 1 shows a topographic map of the sampling sites as provided by NHS. Figure 2 depicts the location of the Georgian sites and was made by NEA.

Four of the sites in this survey were investigated by both teams on the same location at the Alazani/Ganikh but on opposite sides of the river bank. As both teams used different site names for these locations they have been assigned transboundary codes (TB Code) for easier identification and comparison for the purpose of this report. The overview of the sites, their coding and their comparability are listed in the Table 2 below.

Table 2: Overview of sites and coding

Comparable Sites (same locations)			
GE TB Code	**GE Site Name**	**AZ TB Code**	**AZ Site Name**
GEAZ1	Samtatskaro	AZGE1	Ganikh (Alazan) Muganlı
GEAZ2	Sabatlo	AZGE2	Ganikh (Alazan) Lalali
GEAZ3	Vashlovani - Agrichay Confluence	AZGE3	Ganikh (Alazan) Agyazı
GEAZ4	Mijniskure	AZGE4	Ganikh (Mouth)
Additional sites (different locations)			
GE TB Code	**GE Site Name**	**AZ TB Code**	**AZ Site Name**
GE5	Lagodekhi	AZ5	Balakanchay-Downstream
GE6	Chiauri	AZ6	Ayrichay Mouth
GE7	Erisimedi	AZ7	Katekhchay near mouth
		AZ8	Katekhchay near mouth
		AZ9	Talachay near mouth

Table 3: List of sampling sites in Azerbaijan and Georgia.

Country	River	WB	River type[1)]	Site	TB Code	Site No.	HMWB [2)]	Risk [3)]	Significant Pressure [4)]	Latitude	Longitude
Azerbaijan	Ganikh	Gan10-1-WB001	2	Gakh city Mughanli	AZGE1	SW002	No	R	urban, agricultural and transboundary impacts	41°26'21.08''	46°27'20.86''
	Ganikh	Gan10-1-WB001	2	Gakh city Lalali	AZGE2	SW003	No	R	urban, agricultural and transboundary impacts	41°20'51.67''	46°40'16.29'
	Ganikh	Gan10-1-WB001	2	Gakh city Aghyazi	AZGE3	SW004	No	R	urban, agricultural and transboundary impacts	41°15'32.56''	46°41'52.94''
	Ganikh	Gan10-1-WB001	2	Mouth	AZGE4	SW005	Yes	R	urban, agricultural and transboundary impacts	41°615'03''	46°41'52.94''
	Balakhanchay	Gan107-2-WB043	1	Downstream	AZ5	SW001	No	PR	urban, agricultural and transboundary impacts	41°38'21.32''	46°22'1.36''
	Ayrichay	Gan101-2-WB007	1	Mouth	AZ6	SW006	No	R	urban, agricultural and transboundary impacts	41°38'21.32''	46°22'1.36''
	Katekhchay	Gan106-4-WB041	1	Near mouth	AZ7	SW007	Yes	PR	urban, agricultural and transboundary impacts	41°38'21.32''	46°22'1.36''
	Kumrukhchay	Gan102-2-WB020	1	Near mouth	AZ8	SW009	No	PR	urban, agricultural and transboundary impacts	41°38'21.32''	46°22'1.36''
	Talachay mouth	Gan1051-2-WB035	1	Near mouth	AZ9	SW008	No	R	urban, agricultural and transboundary impacts	41°38'21.32''	46°22'1.36''
Georgia	Alazani	-	main river	Samtatskaro	GEAZ1		no	NR	N,	41° 25.8755'N	46° 28.3533'E
	Alazani	-	main river	Sabatlo	GEAZ2		no	NR	N,	41° 20.9654'N	46° 39.8322 'E
	Alazani	-	main river	Vashlovani_Agrichay Confluence	GEAZ3		no	NR	N,	41° 16.0167'N	46° 42.4194'E
	Alazani	-	main river	Mijniskure	GEAZ4		no	NR	N,	41° 08.055'N	46° 39.3581'E
	Shromiskhevi	-	First order tributary	Lagodekhi	GE5		no	RP	H, U, O	41° 49.846'N	46° 16.1447'E
	Alazani	-	main river	Chiauri	GE6		no	NR	N,	41° 40.5572'N	46° 04.9255'E
	Alazani	-	main river	Erisimedi	GE7		no	NR	N,	41° 35.717'N	46° 18.385'E

[1)] Waterbody type as assigned per Azerbaijan or Georgia respectively

[2)] Assignment as provisional HMWB: yes / no

[3)] Assignment of the risk status: R = at risk, PR = possibly at risk, NR = not at risk

[4)] Significant pressure: N = no significant pressure, P = organic pollution, E = eutrophication, T = toxic impact, H = hydro-morphological alterations, M = multi-stressor, O = other, U = unknown

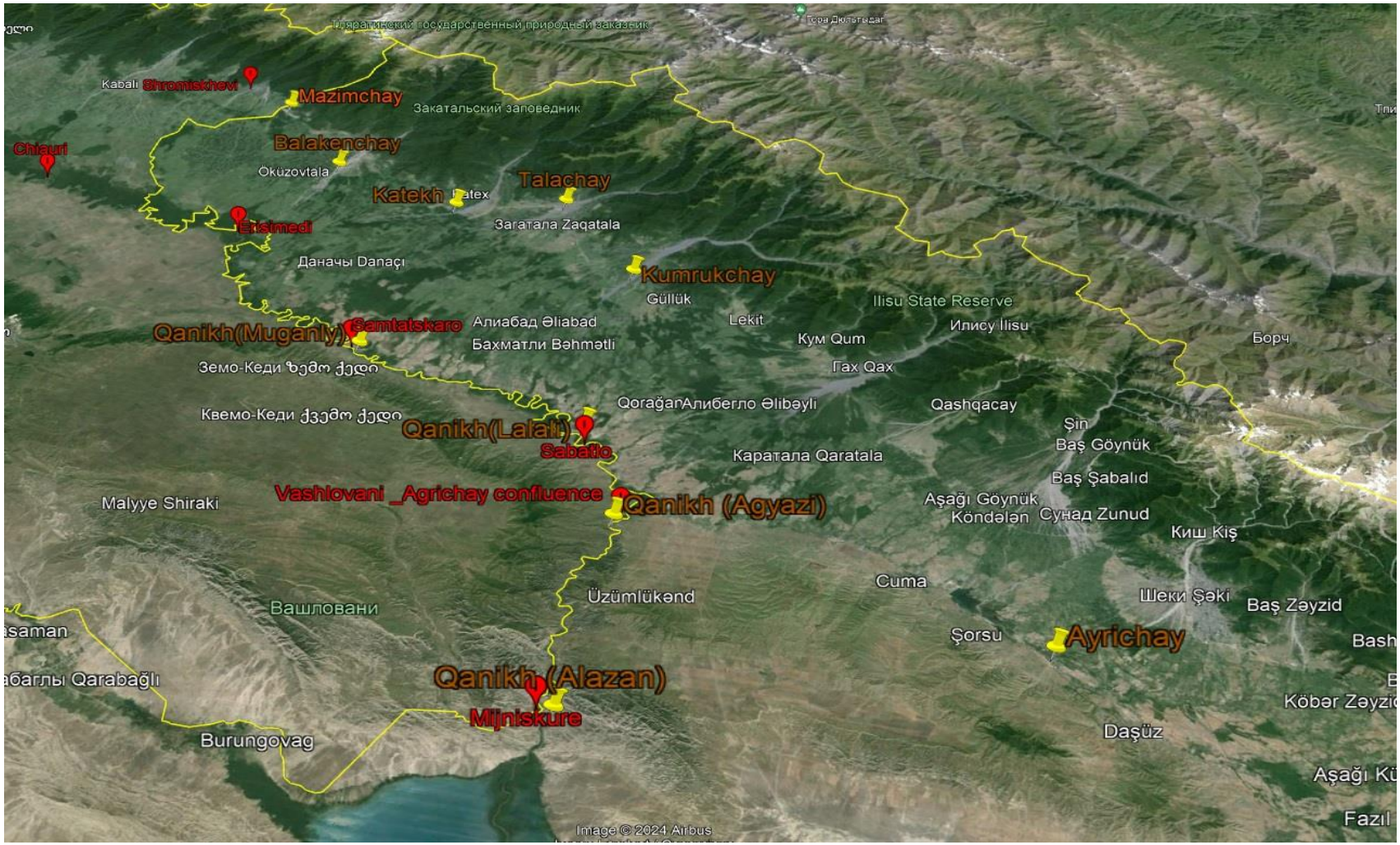

Figure 1: Map of sampling sites prepared by AZ Team. Yellow pins depict AZ sites, red markers the GE sites.

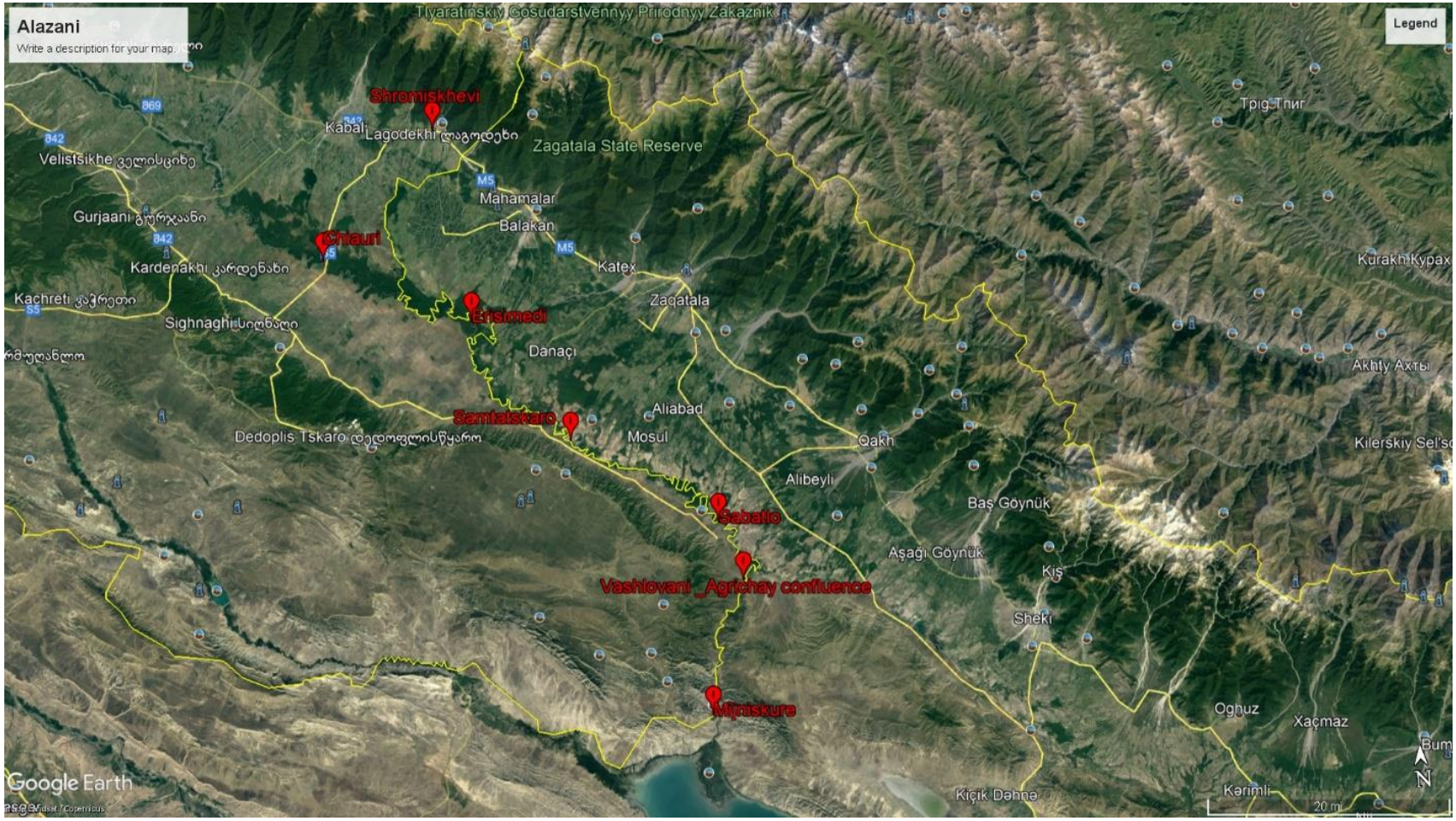

Figure 2: Map of sampling sites prepared by GE Team. Red markers depict GE sites.

2.2. Responsibilities Azerbaijan

Responsibilities	Institution, contact person, email-address
General	AzeLab LLC
Responsible for the organisation of surface water body sampling	**Contact person**: RaminaAbdullayeva E-Mail: abdullayevaramina@gmail.com

Fieldwork	AzeLab LLC, and National Hydrometeorological Service
Responsible for field work (biological and chemical sampling, hydro-morpho-logical site description)	**Contact persons**: Chemistry:GulnaraAbbasova, E-Mail: gulnara_abbasova1980@mail.ru Biology: Ilaha Gurbanova, E-Mail: qurbanovailahe04@gmail.com Huseynova Gulgaz , E-Mail: gulgez.huseynova85@gmail.com Hydromorphology: VafadarIsmayilov, E-Mail: is_vafadar@mail.ru
Responsible for functional check of sampling equipment	**Contact person**: GulnaraAbbasova E-Mail: gulnara_abbasova1980@mail.ru
Responsible for calibration of on-site measuring equipment	**Contact person**: GulnaraAbbasova E-Mail: gulnara_abbasova1980@mail.ru

Chemical analysis	Analyses & reporting: AzeLab LLC; Transport: Sadig LLC
Overall responsible for the chemical analyses in the laboratory, including reporting and data delivery	**Contact person**: Ramina Abdullayeva E-Mail: abdullayevaramina@gmail.com
Responsible for sample transport from the field to the laboratory	**Contact person**: Mirvari Guliyeva Tel: +994502229989
Analysing laboratory and contact person	**Contact person**: Ramina Abdullayeva E-Mail: abdullayevaramina@gmail.com

Biological analysis	AzeLab LLC
Overall responsible for the biological analysis in the lab, including reporting and data delivery	**Contact person**: Ilaha Gurbanova E-Mail:qurbanovailahe04@gmail.com

2.3. Responsibilities Georgia

Responsibilities	Institution, contact person, email-address
General	National Environmental Agency
Responsible for the organisation of surface water body sampling	**Contact person**: Gela Sandodze E-Mail: gela.sandodze@nea.gov.ge

Fieldwork	National Environmental Agency
Responsible for field work (biological and chemical sampling, hydro-morpho-logical site description)	**Contact person:** Gela Sandodze, George Guliashvili, Irakli Kordzaia E-Mail: gela.sandodze@nea.gov.ge giorgi.guliashvili@nea.gov.ge
Responsible for functional check of sampling equipment	**Contact person:** Gela Sandodze, George Guliashvili, Irakli Kordzaia E-Mail: gela.sandodze@nea.gov.ge giorgi.guliashvili@nea.gov.ge
Responsible for calibration of on-site measuring equipment	**Contact person:** Gela Sandodze, George Guliashvili, Irakli Kordzaia E-Mail: gela.sandodze@nea.gov.ge giorgi.guliashvili@nea.gov.ge iraklikrdz414@gmail.com

Chemical analysis	National Environmental Agency
Overall responsible for the chemical analyses in the laboratory, including reporting and data delivery	**Contact person:** Lia Aptsiauri E-Mail: lia.aptsiauri@nea.gov.ge
Responsible for sample transport from the field to the laboratory	**Contact person**: Gela Sandodze, George Guliashvili, Irakli Kordzaia E-Mail: gela.sandodze@nea.gov.ge giorgi.guliashvili@nea.gov.ge
Analysing laboratory and contact person	Contact person: Lia Aptsiauri E-Mail: lia.aptsiauri@nea.gov.ge

Biological analysis	National Environmental Agency
Overall responsible for the biological analysis in the lab, including reporting and data delivery	**Contact person**: Lia Aptsiauri E-Mail: lia.aptsiauri@nea.gov.ge
Reporting	
Overall responsible for completing the technicl report including data annexes and metadata templates	**Contact person**: Lia Aptsiauri E-Mail: lia.aptsiauri@nea.gov.ge

2.4. Quality elements

Both Teams sampled at all intended locations and took the samples back to their respective laboratories for analyses. The Survey included the following physico-chemical parameters and biological quality elements. The list of analyzed parameters differs a bit for each Laboratory, but following list gives an overview of the measured parameters that can be compared after this survey:

Biological Quality Elements:

- Benthic Invertebrates

Chemical and physico-chemical elements

- Field measurements
    - Water Temperature (T), Dissolved Oxygen concentration (DO, mg/L), Dissolved Oxygen aturation (DO, %), pH, Electric Conductivity (EC, µS/cm)
- Laboratory analyses
    - Suspended Solids (TSS, mg/L)
    - Chemical Oxygen Demand (COD, mg/L)
    - Biological Oxygen Demand (BOD_5, mg/L)
    - Ammonia (NH4-N, mg/L)
    - Nitrate (NO3-N, mg/L)
    - Nitrite (NO2, mg/L); (only by NEA)
    - Phosphate (PO4-P, mg/L)
    - Total phosphorus (TP, mg/L); (only by NEA)
    - Chloride (Cl, mg/L)
    - Sulphate (SO_4, mg/L)
    - Sodium (Na, mg/L)
    - Magnesium (Mg, mg/L)
    - Potassium (K, mg/L)
    - Calcium (Ca, mg/L)

3. Methods

3.1. Sampling methods

3.1.1. Chemical sampling

The following general physico-chemical parameters were measured at each site: pH, electrical conductivity, water temperature, dissolved oxygen and oxygen saturation. Chemical analyzes of other parameters were carried out in the laboratory.

Samples were cooled at 4 °C and stored separately according to ISO standards where necessary and transported to the AzeLab LLC laboratory and NEA laboratory respectively.

3.1.2. Biological sampling

Macroinvertebrates were sampled according to the multi-habitat sampling (MHS) method developed during EU AQEM and STAR projects.

For a single sample, up to 20 (depending on the heterogenity of sampling site) sub-samples were taken from every sampling site and transported to the laboratory for further analysis. Rare and endangered animals such as large mussels or crayfish were picked out, documented in the field, and released again. Samples were fixed with ethanol, stored in a cooling box and delivered to the laboratory for sorting and identification.

Phytobenthos was sampled in order to practice the sampling procedure itself. However, as both labs are in there beginning stages of implementing this quality element, no comparison is planned at the moment.

3.2. Field protocols

Hydro-morphological site description where noted and a protocol was filled at each sampling site.

The field protocols (AZ-Annex 2, AZ-Annex 3, GE-Annex 2, GE-Annex 3) for each sampling sites were filled. The protocols include detailed information about river basin, name and type, site number and coordinates, sampling date and time, weather and water quality conditions, name of surveyor with signature and other comments.

3.3. Laboratory analyses

Table 4 lists the analyzed physico-chemical parameters in this survey. Five parameters (Water temperature, Oxygen concentration, Oxygen Saturation, Electric conductivity and pH) were measured in the field by the sampling team. The physico-chemical parameters were measured by the appropriate ISO standard methods and are listed in the table below as well.

Not all parameters were measured by each laboratory. The comparison will therefore only apply to parameters available from both institutions.

Table 4: List of parameters, field and laboratory methods

Parameter	Unit	AZERBAIJAN Standards	GEORGIA Standards	MPC_2
Field measurements			Mobile apparatus -WTW 3630 Multi	
Water temperature (WT)	°C	-	Mobile apparatus -WTW 3630 Multi	
Oxygen concentration (DO)	mg/L		Mobile apparatus -WTW 3630 Multi	
Oxygen saturation (O_2-Sat)	%		Mobile apparatus -WTW 3630 Multi	
pH	-		HI 98108 pH Tester-HANNA	6,5-8,5
Turbidity			HI 98703 Turbidimeter-HANNA	
Electric conductivity (EC)	µS/cm		Mobile apparatus -WTW 3630 Multi	
Laboratory analyses				
Water temperature (WT, lab control)	°C	-		
Oxygen concentration (DO, lab control)	mg/L	ISO 5814	ISO 5815-1:2010	
Oxygen saturation (O2-Sat, lab control)	%	ISO 5814	ISO 5815-1:2010	
pH (lab control)	-	ISO10523	ISO 10523:2010	
Electric conductivity (EC, lab control)	µS/cm	ISO 7888	ISO 7888:2007	
Total suspended solids (TSS)	mg/L	ISO 11923	ISO 11923:2007	
Biological oxygen demand (BOD_5)	mg/L	ISO 5815	ISO 5815-1:2010	6,0
Chemical oxygen demand (COD)	mg/L	ISO 6060	ISO 6060:2010	30,0
Ammonia-N (NH_4-N)	mg/L	ISO 6777	ISO 7150-1:2010	0,39
Nitrate-N (NO_3-N)	mg/L	ISO 7890-3	ISO 10304-1:2007	45,0
Nitrite-N (NO_2-N)	mg/L	-	ISO 10304-1:2007	3,3
Orthophosphate, as P (PO_4-P)	mg/L	ISO 6878	ISO 10304-1:2007	3,5
Total phosphorus (TP)	mg/L	-	Ю.Ю. Лурье ”Унифици¬ро¬ва¬¬¬н¬¬ные методы анализа вод”	
Chloride (Cl)	mg/L	ISO 9297	ISO 10304-1:2007	350
Sulphate, total ion (SO_4)	mg/L	ISO 9280	ISO 10304-1:2007	500
Calcium (Ca)	mg/L	ISO 11885	ISO 6058:2008	
Magnesium (Mg)	mg/L	ISO 11885	ISO 6058:2008	
Sodium (Na)	mg/L	ISO 11885	ISO 11885:2007	
Potassium (K)	mg/L	ISO 11885	ISO 11885:2007	

[2] Maximum permissible concentrations On Approval of Technical Regulations for Protection of Surface Water Pollution in Georgia (Government of Georgia Resolution # 425 December 31, 2013 Tbilisi

3.4. Quality assurance

AzeLab and NHS:

Analyzes were conducted according to ISO standards. The used device, equipment and chemical containers have been checked by the calibration institution and have certificates. Before the analyses, the calibration curves were updated and checked with quality samples.

NEA:

Analytical samples were brought to the laboratory on October 25, 2023, the analyses started on the same day. The results of the determined parameters were compared with the Approval of Technical Regulations for Protection of Surface Water Pollution in Georgia (Government of Georgia Resolution N425 December 31, 2013 Tbilisi).

4. Results

4.1. Field protocols and hydro-morphological site description

The Tables Table 4, Table 5, and Table 6 give an overview of the hydrological and meteorological conditions observed and recorded by the Azeri and Georgian experts.

For determining water flow, hydrometric a current meter (http://www.akim.com.tr/en/products/yuzey-sulari-c-19/universal-mulinecm-32-u-18) and an acoustic Doppler current profiler (https://geo-matching.com/categories/adcps-acoustic-doppler-current-profilers) were used by the Georgian experts.

Table 5: Sampling dates and information on meteorological (Met) and hydrological (Hyd) conditions as observed by NEA.

Basin	River	Site	TB Code	Date	Time	Team	Met	Hyd	Elevation [m]
Alazani	Shromiskhevi	Lagodekhi	GE5	23.10.2023	15:20	GS IK GG AG	Dry	low	488
Alazani	Alazani	Chiauri	GE6	23.10.2023	16:50	GS IK GG AG	Dry	low	211
Alazani	Alazani	Erisimedi	GE7	23.10.2023	18:40	GS IK GG AG	Dry	Low	197
Alazani	Alazani	Samtatskaro	GEAZ1	24.10.2023	12:00	GS IK GG AG	Dry	Low	488
Alazani	Alazani	Sabatlo	GEAZ2	24.10.2023	14:25	GS IK GG AG	Dry	Medium	165
Alazani	Alazani	Vashlovani _Agrichay Confluence	GEAZ3	24.10.2023	16:05	GS IK GG AG	Dry	Medium	158
Alazani	Alazani	Mijniskure	GEAZ4	24.10.2023	18:00	GS IK GG AG	Dry	Low	104

Table 6: Water discharge and flow morphometric parameters measured in the field observed by NEA.

DATE	TIME	RIVER NAME	TB Code	WATER DISCHARGE	cross-sectional area	Average Velocity	River Width	Average depth
				Q, M³/SC	**F, M²**	**V, m/s**	**B, m.**	**H, m.**
23.10.2023	18:45-19:00	Alazani - Erisimedi	GE7	38.5	77.60	0.50	56.0	1.39
24.10.2023	14:20-14:50	Alazani - Sabatlo	GEAZ2	62.2	96.20	0.65	90.0	1.07
23.10.2023	16:40-14:10	Alazani - Chiauri	GE6	31.7	75.20	0.42	50.7	1.48
23.10.2023	16:40-17:10	Lagodekhiskhevi - Lagodekhi	GE5	0.24	0.56	0.43	2.5	0.22
				0.23	0.48	0.48	4.0	0.12
		∑		**0.47**	--	--	--	--
24.10.2023	12:00-12:20	Alazani - Samtatskaro	GEAZ1	52.8	75.0	0.70	50.0	1.50
24.10.2023	18:00-18:50	Alazani - Mijniskure	GEAZ4	89.0	84.5	1.05	60.0	1.41
24.10.2023	16:05-16:30	Alazani -Vashlovani _Agrichay Confluence	GEAZ3	79.0	86.0	0.92	65.0	1.15

Table 7: Time, meteorology, hydrology as observed by NHS and AzeLab LLC.

Sampling date	Sampling point	TB Code	Hydrology	Meteorology
23.10.2023	Balakhanchay downstream	AZ5	Discharge: Width:	t-19^{0}C
24.10.2023	Ganikh Mughanli	AZGE1	Discharge: 50 m^3/s Width: 20 m	t-21^{0}C
	Ganikh Lalali	AZGE2	Dischargem^3/s Width: 24m	t-21^{0}C
	Ganikh Aghyazi	AZGE3	Discharge: m^3/s Width: 28 m	t-21.2^{0}C
25.10.2023	Ganikh mouth	AZGE4	Discharge: 0.5 m^3/s Width: 15 m	t-17.2^{0}C
	Ayrichay mouth	AZ6	Discharge: 8.4 m^3/s Width: 15 m	t-21^{0}C
26.10.2023	Katekh near mouth	AZ7	Discharge:150 m^3/s Width:20m	t-17^{0}C
	Talachay mouth	AZ9	Discharge:35 m^3/s Width:15 m	t-19^{0}C
	Kumrukhchay near mouth	AZ8	Discharge: 3.1 m^3/s Width: 10m	t-21^{0}C

4.1.1. Site description by NEA (GE)

The following description of the river basin and sites was provided by the Georgian experts.

Riv. Alazani - To the north the Alazani river basin is bordered by the southern slope of the Caucasus Range, to the south and south-west by Kakheti, the Tsiv-Gombori ridges and the Iori valley and to the south-east by Azerbaijan. The basin has three distinct landscapes: the steep slopes of bordering ridges; foothills and stretching downhills of a plain that is mainly built from the cone-shaped deposits brought down from the tributaries of the river Alazani, and the flat parts of the plain.

The river Alazani's headwater comes from the southern slope of the Caucasus Range close to the Borbalo Mountain at 2,750 m asl. The section from the spring to the confluence with Samkuristskali is called Tsiplovanitskali (Tsiplovani water), while after both rivers are united - Alazani. Near the village Kortabude the river comes out from the narrow gorge and streams down the wide Pankisi Gorge at the length of 18 km, up to the river Ilto confluence. Then it flows to the south-east across the Alazani valley and having taken the direction to the south joins with the Mingechevir reservoir on the Azerbaijan territory. Dry gullies/ravines are common in the south-eastern part of the right side of the river.

Main characteristics of Alazani river

Length of the river: 390 km

Catchment area: 16,920 km² (including the basin located in Azerbaijan)

Average altitude of the basin: 850 m

Difference between head and source: 745 m

Average slope: 2.12%

There are more than 500 rivers in the basin, with the total length of 1,770 km. Important tributaries: Ilto (length 43 km), Khodasheniskhevi (length 31), Stori (length 38 km), Turdo (length 28 km), Lopota (length

33 km), Chelti (length 28km), Kisiskhevi (length 37 km), Duruji (length 26 km), Chermiskhevi (length 35 km) etc.

The left tributaries of the river Alazani that flow down on the southern steep slope of the Caucasus Range are characterized by sufficient water discharge, narrow deep gorges (ravines) and beds with rapids and waterfalls. They cause intense deep erosion and create cone-shaped deposits by bringing out a considerable amount of debris, branch out and by the narrow bed join with the river Alazani. Right tributaries are characterized by relatively less waters and have a smaller slope.

The geological structure of the mountainous part of the left bank side of the basin is formed by sandstone and clay slabs, while the right side predominantly contains limestone and partially marl. The main rock layers are covered by sand and clay (loam) and soil ground. River feeding sources: Groundwater – 40%, rain– 31%, snowmelt – 29%. Low levels of water in the winter, floods in the spring and summer during heavy rains.

The Alazani river and its tributaries are characterized by fluctuating water flow: spring – 37%, summer – 31 %, autumn – 21 %, winter – 11%, during which the river does not freeze. The yearly runoff of the river Alazani (within Georgia) equals to 3.10 km³ (570 mm). The river runoff module in the direction of the current fluctuates within 49.0-9.00 l/sec km². Both sides of the river tributaries are characterized by mudflows.

Water balance: Precipitation – 800 mm, evaporation - 470 mm, runoff – 330 mm, underground runoff – 135 mm. The loss (the total amount of surface runoff and non-productive evaporation) makes 66%. River water is characterized by little salinity and is mainly used for irrigation purposes.

The Lagodekhistskali River – the river in Lagodekhi region, the right tributary of the river Mitsimistskali starts on the southern slope of the Caucasus Range (length - 31 km, basin area – 98 km^2). It is fed by snowmelt, rain and groundwater. Floods occur in spring and low water levels in summer, winter and autumn. Annual average discharge – 2.5 m 3 /sec. The river is used for irrigation.

Site Number 1 (TB Code GE7) - Alazani Erisimedi In this area there is intense erosion, the natural state of the river is less maintained. There are many water intakes by reclamation systems above the Erisimedi intersection. The stream is characterized by laminar flow. Erosion processes are present. The riverbed is made up of pebbles, sand and silt.

Reporter's Note:

We were not allowed to take a photo at the intersection of Alazani Erisimedi, so the photo of previous years was included in GE-Annex 7.

Site Number 2 (TB Code GEAZ2) - Lateral erosion is active in the Sabatlo section. During floods, water fills the bed and overflows the banks. The river banks are covered with bushes and tall plants. At the top there are water intakes by reclamation systems. The river bed is characterised by pebbles, sand and silt.

Site Number 3 (TB Code GE6) - Lateral erosion is active in Chiauri section. During floods, water fills the bed and overflows the banks. The banks are covered with bushes and tall plants. At the top there are water intakes by reclamation systems. There is vegetation in the stream that changes the flow patterns of the stream. The bottom is silian and smooth. At the bottom of the bed there are pebbles, sand and silt.

Site Number 4 (TB Code GE5) - River Lagodekhiskhevi. The sampling point is located near the city of Lagodek. The stream flows in two branches. The sediment of the river bed is characterized by prevalent rocky material and pebbles. The river causes intense erosion. For protection against erosion, embankment structures have been constructed. There are islands and vegetation present within the river. Household waste was observed.

Site Number 5 (TB Code GEAZ1) - Lateral and vertical erosion is active in the Samtatskaro section. In the upper part of the intersection, water intake is carried out by the reclamation systems. During high water levels, the river floods the surrounding area.

Site Number 6 (TB Code GE4) - The section of Mijniskure is characterized by active erosion processes. The bed is covered with pebbles, silt and silt. At the top of the intersection reclamation systems with ditches are present.

Site Number 7 (TB Code GEAZ3) - The section is located after the confluence of the Agrichai River with the Alazani River. A hydrological station is located here. Lateral erosion processes are active. The banks are covered with trees and vegetation. Cachar-pebble, silt, silt can be found in the bed. The water flow is characterized by laminar flow.

The hydro-morphological site descriptions by Azeri experts are given in AZ-Annex 3.

4.2. Chemical results

The general assessment from comparing the results of both laboratories indicates that only a part of the parameters concur with similar data. Where differences occur, both parties are encouraged to review their approach and methods. **In the scope of this report, it is not possible to determine the exact reason for the discrepancies**.

Table 8 lists the results as they were reported to Umweltbundesamt and can herewith be compared. There are more parameters that have been analysed, but comparison is not possible, as they were not analysed by both labs.

Table 9 to Table 15 compare the single parameters. Here, UBA experts provide a first assessment. Values marked in red show significant differences at the same sampling site, values marked in green are estimated to have an acceptable deviation from each other.

Table 8: Reported comparable physico-chemical parameters – Azerbaijan and Georgia

River	Sampling site	TB Code	T	Cond.	pH	O2	O2	NO3	NO2	NH4 mgN/l	PO4	SO4	CL	BOD5	COD	K	Na	Ca	Mg	*TSS*	*Ptot*
			°C	µsms/cm		mg/L	%	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	*mg/L*	*mg/L*
Ganikh	Muganlı	AZGE1	15,3	646	8,2	5,5	62	0,71	-	0	0,1	92,05	35,32	5,84	8,34	0,7	5,58	79,1	20,6	413,4	-
Ganikh	Lalali	AZGE2	17	611	7,8	4,8	53	0,91	-	0	0,12	81,3	31,56	2,6	3,71	1	10,04	68,7	17,88	391	-
Ganikh	Agyazı	AZGE3	16,5	543	7,6	5,8	67	1,98	-	0	0,28	90,38	28,56	2	2,86	1,7	25,4	61,9	16,1	347,5	-
Ganikh	Mouth	AZGE4	15	605	7,8	5,4	59	0,13	-	0	0,13	101,1	14,3	8,65	12,36	5,2	14,1	71,1	18,5	387,2	-
Balakanchay	Balakanchay-Downstream	AZ5	16,1	314	8	7,8	88	0,42	-	0	0,11	91,54	3	3,1	4,4	0,7	5,03	42,6	11,1	200,9	-
Ayrichay	Ayrichay Mouth	AZ6	17	465	8,1	6,2	73	0,76	-	0	0,14	96,77	12,03	4	5,71	4,7	29,2	58,6	15,2	297,6	-
Katekhchay	Katekhchay near mouth	AZ7	15	170	8,4	7,6	83	0,23	-	0	0,16	16,7	6,76	5,8	8,28	0,6	5,99	22	5,73	108,8	-
Kurmukhchay	Kurmukhchay near mouth	AZ8	18	470	8,2	5,8	53	0,05	-	0,12	0,09	82,16	3,76	7,6	10,85	1,9	1,94	65,2	16,96	301,1	-
Talachay	Talachay near mouth	AZ9	17,1	350	8,1	7,2	81	0,04	-	0	0,21	60,2	6	7,9	11,28	1,1	10,46	43,8	11,4	224	-

River	Sampling site	TB Code	T	Cond.	pH	O2	O2	NO3	NO2	NH4 mgN/l	PO4	SO4	CL	BOD5	COD	K	Na	Ca	Mg	*TSS*	*Ptot*
			°C	µsms/cm		mg/L	%	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	*mg/L*	*mg/L*
Alazani	Samtatskaro	GEAZ1	15,8	547	8,22	9,51	97,6	3,412	0,043	0,32	0,085	111,81	39,29	1,62	2,81	1,57	43,24	64,32	29,18	134	0,155
Alazani	Sabatlo	GEAZ2	16	533	8,25	9,47	97,9	3,08	0,226	0,31	0,075	122,79	38,97	1,72	2,55	2,45	41,23	63,84	28,11	280	0,135
Alazani	Vashlovani _Agrichay Confluence	GEAZ3	17,5	545	8,3	9,18	97,4	2,962	0,207	0,3	0,053	120,23	41,12	1,42	2,61	2,62	41,36	67,77	26,12	1022	0,123
Alazani	Mijniskure	GEAZ4	16,6	552	8,23	9,36	97,4	3,011	0,136	0,27	0,057	131,18	37,06	1,52	2,75	2,58	36,77	68,33	27,24	1056	0,117
Shromiskhevi	Lagodekhi	GE5	14,5	89,9	8,13	9,61	99,4	0,734	0,012	0,17	0,046	11,68	7,43	1,62	2,25	2,85	3,23	16,24	4,35	2	0,106
Alazani	Chuiari	GE6	15,5	367	8,25	9,74	99,3	4,417	0,024	0,37	0,217	44,19	9,69	1,42	2,18	1,08	15,75	58,39	24,22	54	0,277
Alazani	Erisimedi	GE7	15,5	530	8,3	9,54	97	3,885	0,073	0,26	0,032	96,39	36,14	1,41	2,62	2,93	40,9	60,47	26,07	86	0,102

Chemical Parameter Comparison

FIELD MEASUREMENTS

The measurements of temperature, conductivity and pH are somewhat comparable. Although it can be observed that pH on the Georgian side are always sligthy higher than the Azeri measurements. Which value is more accurate cannot be determined within this report.

Oxygen levels are very low on the Azeri side considering the relatively natural conditions of the rivers. In case these were really field measurements, the O_2 measuring instrument needs to be checked and calibrated.

Table 9: Comparison field measurements

Lab	River	Sampling site	TB Code	T	Cond.	pH	O_2	O_2
				°C	µsms/cm		mg/L	%
NEA	Alazani	Samtatskaro	GEAZ1	15,8	547	8,22	9,51	97,6
AzeLab	Ganikh	Muganlı	AZGE1	15,3	646	8,2	5,5	62
NEA	Alazani	Sabatlo	GEAZ2	16	533	8,25	9,47	97,9
AzeLab	Ganikh	Lalali	AZGE2	17	611	7,8	4,8	53
NEA	Alazani	Vashlovani _Agrichay Confluence	GEAZ3	17,5	545	8,3	9,18	97,4
AzeLab	Ganikh	Agyazı	AZGE3	16,5	543	7,6	5,8	67
NEA	Alazani	Mijniskure	GEAZ4	16,6	552	8,23	9,36	97,4
AzeLab	Ganikh	Mouth	AZGE4	15	605	7,8	5,4	59
NEA	Shromiskhevi	Lagodekhi	GE5	14,5	89,9	8,13	9,61	99,4
NEA	Alazani	Chuiari	GE6	15,5	367	8,25	9,74	99,3
NEA	Alazani	Erisimedi	GE7	15,5	530	8,3	9,54	97
AzeLab	Balakanchay	Balakanchay-Downstream	AZ5	16,1	314	8	7,8	88
AzeLab	Ayrichay	Ayrichay Mouth	AZ6	17	465	8,1	6,2	73
AzeLab	Katekhchay	Katekhchay near mouth	AZ7	15	170	8,4	7,6	83
AzeLab	Kurmukhchay	Kurmukhchay near mouth	AZ8	18	470	8,2	5,8	53
AzeLab	Talachay	Talachay near mouth	AZ9	17,1	350	8,1	7,2	81

NITRATE, NITRITE, AMMONIA

In the case of Nitrate the difference in the reported results are suspected to be due to AzeLab values reporting the N of NH_3, while NEA values concern the whole molecule. When the NEA values are converted (see Table 10, “NEA adjusted”), the results reach comparable levels for the first two sites. The values of the third and fourth site also approximate each other, but still deviate. It is recommended that both laboratories communicate with each other to confirm if these assumptions are correct. For further comparisons like future transboundary surveys and proficiency tests, it is important to report in the correct unit for the corresponding parameter, in order to avoid misleading results.

Nitrite was only measured by NEA. Ammonium is not possible to compare, as AzeLab reported all values as "0" except site AZ8.

Table 10: Nitrate, Nitrite, and Ammonia

Lab	River	Sampling site	TB Code	NO_3	NO_2	NH_4 mgN/L
				mg/L	mg/L	mg/L
NEA	Alazani	Samtatskaro	GEAZ1	3,412	0,043	0,32
NEA adjusted				0,77		
AzeLab	Ganikh	Muganlı	AZGE1	0,71	-	0
NEA	Alazani	Sabatlo	GEAZ2	3,08	0,226	0,31
NEA adjusted				0,7		
AzeLab	Ganikh	Lalali	AZGE2	0,91	-	0
NEA	Alazani	Vashlovani _Agrichay Confluence	GEAZ3	2,962	0,207	0,3
NEA adjusted				0,67		
AzeLab	Ganikh	Agyazı	AZGE3	1,98	-	0
NEA	Alazani	Mijniskure	GEAZ4	3,011	0,136	0,27
NEA adjusted				0,68		
AzeLab	Ganikh	Mouth	AZGE4	0,13	-	0
NEA	Shromiskhevi	Lagodekhi	GE5	0,734	0,012	0,17
NEA	Alazani	Chuiari	GE6	4,417	0,024	0,37
NEA	Alazani	Erisimedi	GE7	3,885	0,073	0,26
AzeLab	Balakanchay	Balakanchay-Downstream	AZ5	0,42	-	0
AzeLab	Ayrichay	Ayrichay Mouth	AZ6	0,76	-	0
AzeLab	Katekhchay	Katekhchay near mouth	AZ7	0,23	-	0
AzeLab	Kurmukhchay	Kurmukhchay near mouth	AZ8	0,05	-	0,12
AzeLab	Talachay	Talachay near mouth	AZ9	0,04	-	0

PHOSPHATE, TOTAL PHOSPHORUS

Phosphate reaches comparable results at the first to sites, while differing at sites 3 and 4. Total phosphorus was only reported by NEA.

Table 11: Phosphate and Total Phosphorus.

Lab	River	Sampling site	TB Code	PO_4	Ptot
				mg/L	mg/L
NEA	Alazani	Samtatskaro	GEAZ1	0,085	0,155
AzeLab	Ganikh	Muganlı	AZGE1	0,1	-
NEA	Alazani	Sabatlo	GEAZ2	0,075	0,135
AzeLab	Ganikh	Lalali	AZGE2	0,12	-

Lab	River	Sampling site	TB Code	PO_4	Ptot
				mg/L	mg/L
NEA	Alazani	Vashlovani _Agrichay Confluence	GEAZ3	0,053	0,123
AzeLab	Ganikh	Agyazı	AZGE3	0,28	-
NEA	Alazani	Mijniskure	GEAZ4	0,057	0,117
AzeLab	Ganikh	Mouth	AZGE4	0,13	-
NEA	Shromiskhevi	Lagodekhi	GE5	0,046	0,106
NEA	Alazani	Chuiari	GE6	0,217	0,277
NEA	Alazani	Erisimedi	GE7	0,032	0,102
AzeLab	Balakanchay	Balakanchay-Downstream	AZ5	0,11	-
AzeLab	Ayrichay	Ayrichay Mouth	AZ6	0,14	-
AzeLab	Katekhchay	Katekhchay near mouth	AZ7	0,16	-
AzeLab	Kurmukhchay	Kurmukhchay near mouth	AZ8	0,09	-
AzeLab	Talachay	Talachay near mouth	AZ9	0,21	-

SULPHATE, CHLORIDE

All of the Sulphate results at the comparable sites deviate significantly from each other. Chloride seems to be comparable for the first 2 sites, while the results at the last 2 sites are significantly different. Reasons for the differences remain unknown.

Table 12: Sulphate and Chloride.

Lab	River	Sampling site	TB Code	SO_4	CL
				mg/L	mg/L
NEA	Alazani	Samtatskaro	GEAZ1	111,81	39,29
AzeLab	Ganikh	Muganlı	AZGE1	92,05	35,32
NEA	Alazani	Sabatlo	GEAZ2	122,79	38,97
AzeLab	Ganikh	Lalali	AZGE2	81,3	31,56
NEA	Alazani	Vashlovani _Agrichay Confluence	GEAZ3	120,23	41,12
AzeLab	Ganikh	Agyazı	AZGE3	90,38	28,56
NEA	Alazani	Mijniskure	GEAZ4	131,18	37,06
AzeLab	Ganikh	Mouth	AZGE4	101,1	14,3
NEA	Shromiskhevi	Lagodekhi	GE5	11,68	7,43
NEA	Alazani	Chuiari	GE6	44,19	9,69
NEA	Alazani	Erisimedi	GE7	96,39	36,14
AzeLab	Balakanchay	Balakanchay-Downstream	AZ5	91,54	3
AzeLab	Ayrichay	Ayrichay Mouth	AZ6	96,77	12,03
AzeLab	Katekhchay	Katekhchay near mouth	AZ7	16,7	6,76

Lab	River	Sampling site	TB Code	SO_4	CL
				mg/L	mg/L
AzeLab	Kurmukhchay	Kurmukhchay near mouth	AZ8	82,16	3,76
AzeLab	Talachay	Talachay near mouth	AZ9	60,2	6

Biological Oxygen Demand, Chemical Oxygen Demand

Deviations between the BOD_5 and COD results NEA and Azelab can be observed. The most significant differences are at Site 1 and Site 4.

Table 13: BOD_5 and COD.

Lab	River	Sampling site	TB Code	BOD_5	COD
				mg/L	mg/L
NEA	Alazani	Samtatskaro	GEAZ1	1,62	2,81
AzeLab	Ganikh	Muganlı	AZGE1	5,84	8,34
NEA	Alazani	Sabatlo	GEAZ2	1,72	2,55
AzeLab	Ganikh	Lalali	AZGE2	2,6	3,71
NEA	Alazani	Vashlovani _Agrichay Confluence	GEAZ3	1,42	2,61
AzeLab	Ganikh	Agyazı	AZGE3	2	2,86
NEA	Alazani	Mijniskure	GEAZ4	1,52	2,75
AzeLab	Ganikh	Mouth	AZGE4	8,65	12,36
NEA	Shromiskhevi	Lagodekhi	GE5	1,62	2,25
NEA	Alazani	Chuiari	GE6	1,42	2,18
NEA	Alazani	Erisimedi	GE7	1,41	2,62
AzeLab	Balakanchay	Balakanchay-Downstream	AZ5	3,1	4,4
AzeLab	Ayrichay	Ayrichay Mouth	AZ6	4	5,71
AzeLab	Katekhchay	Katekhchay near mouth	AZ7	5,8	8,28
AzeLab	Kurmukhchay	Kurmukhchay near mouth	AZ8	7,6	10,85
AzeLab	Talachay	Talachay near mouth	AZ9	7,9	11,28

Potassium, Sodium, Calcium, Magnesium

The results of Kalium, Natrium, and Magnesium deviate significantly. Calcium levels appear to be comparable.

Table 14: Potassium, Natrium, Calcium, and Magnesium.

Lab	River	Sampling site	TB Code	K	Na	Ca	Mg
				mg/L	mg/L	mg/L	mg/L
NEA	Alazani	Samtatskaro	GEAZ1	1,57	43,24	64,32	29,18
AzeLab	Ganikh	Muganlı	AZGE1	0,7	5,58	79,1	20,6
NEA	Alazani	Sabatlo	GEAZ2	2,45	41,23	63,84	28,11
AzeLab	Ganikh	Lalali	AZGE2	1	10,04	68,7	17,88
NEA	Alazani	Vashlovani _Agrichay Confluence	GEAZ3	2,62	41,36	67,77	26,12
AzeLab	Ganikh	Agyazı	AZGE3	1,7	25,4	61,9	16,1
NEA	Alazani	Mijniskure	GEAZ4	2,58	36,77	68,33	27,24
AzeLab	Ganikh	Mouth	AZGE4	5,2	14,1	71,1	18,5
NEA	Shromiskhevi	Lagodekhi	GE5	2,85	3,23	16,24	4,35
NEA	Alazani	Chuiari	GE6	1,08	15,75	58,39	24,22
NEA	Alazani	Erisimedi	GE7	2,93	40,9	60,47	26,07
AzeLab	Balakanchay	Balakanchay-Downstream	AZ5	0,7	5,03	42,6	11,1
AzeLab	Ayrichay	Ayrichay Mouth	AZ6	4,7	29,2	58,6	15,2
AzeLab	Katekhchay	Katekhchay near mouth	AZ7	0,6	5,99	22	5,73
AzeLab	Kurmukhchay	Kurmukhchay near mouth	AZ8	1,9	1,94	65,2	16,96
AzeLab	Talachay	Talachay near mouth	AZ9	1,1	10,46	43,8	11,4

TOTAL SUSPENDED SOLIDS

The values of Total Suspended Solids (TSS) differ significantly, but no general trend between the laboratories is observable, as sometime the values of AzeLab are higher than NEA, or vice versa. The very high values of NEA at GEAZ3 and GEAZ4 are surprising.

Table 15: Total Suspended Solids.

Lab	River	Sampling site	TB Code	TSS
				mg/L
NEA	Alazani	Samtatskaro	GEAZ1	134
AzeLab	Ganikh	Muganlı	AZGE1	413,4
NEA	Alazani	Sabatlo	GEAZ2	280
AzeLab	Ganikh	Lalali	AZGE2	391
NEA	Alazani	Vashlovani _Agrichay Confluence	GEAZ3	1022
AzeLab	Ganikh	Agyazı	AZGE3	347,5
NEA	Alazani	Mijniskure	GEAZ4	1056
AzeLab	Ganikh	Mouth	AZGE4	387,2
NEA	Shromiskhevi	Lagodekhi	GE5	2

Lab	River	Sampling site	TB Code	TSS
				mg/L
NEA	Alazani	Chuiari	GE6	54
NEA	Alazani	Erisimedi	GE7	86
AzeLab	Balakanchay	Balakanchay-Downstream	AZ5	200,9
AzeLab	Ayrichay	Ayrichay Mouth	AZ6	297,6
AzeLab	Katekhchay	Katekhchay near mouth	AZ7	108,8
AzeLab	Kurmukhchay	Kurmukhchay near mouth	AZ8	301,1
AzeLab	Talachay	Talachay near mouth	AZ9	224

4.3. Biological results

Table 16 lists the benthic invertebrates found at the comparable sites on the opposite banks of the river. Table 17 contains the taxa list of the additional sites as sampled in the Azeri campaign and Table 18 all taxa observed at the additional sites in the Georgian survey.

Table 16: Taxa list of comparable sites.

TB Code	Site Name	Country-Team	Major Group	Order	Family	Taxon name	AQEM code	Ind
GEAZ1	Samtatskaro	Georgia	Insecta	Diptera	Chironomidae	Chironomidae Gen. sp.	4642	1
GEAZ1	Samtatskaro	Georgia	Insecta	Odonata	Gomphidae	Gomphidae Gen. sp.	8410	1
GEAZ1	Samtatskaro	Georgia	Insecta	Diptera	Limoniidae	Hexatoma sp.	5481	1
GEAZ1	Samtatskaro	Georgia	Insecta	Trichoptera	Hydropsychidae	Hydropsyche sp.	5605	1
GEAZ1	Samtatskaro	Georgia	Insecta	Ephemeroptera	Ameletidae	Ameletidae	14627	3
AZGE1	Muganlı	Azerbaijan	Insecta	Odonata	Gomphidae	Gomphus	5331	4
AZGE1	Muganlı	Azerbaijan	Insecta	Odonata	Gomphidae	Gomphinae	19867	5
AZGE1	Muganlı	Azerbaijan	Insecta	Ephemeroptera	Baetidae	Baetis rhodani	4415	4
AZGE1	Muganlı	Azerbaijan	Insecta	Ephemeroptera	Baetidae	Baetis alpinus	4381	3
AZGE1	Muganlı	Azerbaijan	Insecta	Diptera	Chironomidae	Chironomus	4663	5
AZGE1	Muganlı	Azerbaijan	Insecta	Diptera	Simuliidae	Simulium	6853	3
AZGE1	Muganlı	Azerbaijan	Crustacea	Decapoda	Gammaridae	Gammarus balcanicus	12330	4
GEAZ2	Sabatlo	Georgia	Insecta	Ephemeroptera	Baetidae	Baetis sp.	4419	12
GEAZ2	Sabatlo	Georgia	Insecta	Odonata	Gomphidae	Gomphidae Gen. sp.	8410	2
GEAZ2	Sabatlo	Georgia	Insecta	Trichoptera	Hydropsychidae	Hydropsyche sp.	5605	6
GEAZ2	Sabatlo	Georgia	Insecta	Ephemeroptera	Heptageniidae	Rhithrogena sp.	6747	1
GEAZ2	Sabatlo	Georgia	Insecta	Ephemeroptera	Prosopistomatidae	Prosopistoma	13695	3
GEAZ2	Sabatlo	Georgia	Insecta	Ephemeroptera	Polymitarcyidae	Ephoron	8978	5
AZGE2	Lalali	Azerbaijan	Insecta	Ephemeroptera	Heptageniidae	Ecdyonurus	5053	2
AZGE2	Lalali	Azerbaijan	Insecta	Ephemeroptera	Baetidae	Baetis rhodani	4415	5
AZGE2	Lalali	Azerbaijan	Insecta	Diptera	Chironomidae	Chironomus	4663	4
AZGE2	Lalali	Azerbaijan	Insecta	Diptera	Simuliidae	Simulium	6853	3
GEAZ3	Vashlovani _Agrichay Confluence	Georgia	Insecta	Odonata	Gomphidae	Gomphidae Gen. sp.	8410	2
GEAZ3	Vashlovani _Agrichay Confluence	Georgia	Insecta	Trichoptera	Hydropsychidae	Hydropsyche sp.	5605	20

TB Code	Site Name	Country-Team	Major Group	Order	Family	Taxon name	AQEM code	Ind
GEAZ3	Vashlovani _Agrichay Confluence	Georgia	Insecta	Ephemeroptera	Heptageniidae	Rhithrogena sp.	6747	4
GEAZ3	Vashlovani _Agrichay Confluence	Georgia	Insecta	Diptera	Simuliidae	Simulium sp.	6853	6
GEAZ3	Vashlovani _Agrichay Confluence	Georgia	Insecta	Ephemeroptera		Ephemeroptera sp.		1
AZGE3	Agyazı	Azerbaijan	Insecta	Ephemeroptera	Baetidae	Baetis lutheri	4406	3
AZGE3	Agyazı	Azerbaijan	Insecta	Diptera	Simuliidae	Simulium	6853	5
AZGE3	Agyazı	Azerbaijan	Insecta	Diptera	Chironomidae	Chironomus	4663	11
GEAZ4	Mijniskure	Georgia	Insecta	Odonata	Gomphidae	Gomphidae Gen. sp.	8410	1
GEAZ4	Mijniskure	Georgia	Insecta	Trichoptera	Hydropsychidae	Hydropsyche sp.	5605	16
GEAZ4	Mijniskure	Georgia	Annelida	Oligochaeta	Tubificidae	Tubifex tubifex	7116	1
GEAZ4	Mijniskure	Georgia	Insecta	Ephemeroptera	Prosopistomatidae	Prosopistoma	13695	1
GEAZ4	Mijniskure	Georgia	Insecta	Heteroptera	Aphelocheiridae	Aphelocheirus aestivalis	4335	1
AZGE4	Qanikh (Mouth)	Azerbaijan	Insecta	Trichoptera	Hydropsychidae	Hydropsyche siltalai	5604	11
AZGE4	Qanikh (Mouth)	Azerbaijan	Insecta	Ephemeroptera	Baetidae	Baetis alpinus	4381	5
AZGE4	Qanikh (Mouth)	Azerbaijan	Insecta	Ephemeroptera	Heptageniidae	Ecdyonurus	5053	4
AZGE4	Qanikh (Mouth)	Azerbaijan	Insecta	Diptera	Chironomidae	Chironomus	10905	5
AZGE4	Qanikh (Mouth)	Azerbaijan	Insecta	Diptera	Simuliidae	Simulium	6853	8

Table 17: Taxa list of additional Azeri sites.

TB Code	Site Name	Country-Team	Major Group	Order	Family	Taxon name	AQEM code	Ind
AZ5	Balakanchay-Downstream	Azerbaijan	Insecta	Trichoptera	Hydropsychidae	Hydropsyche fulvipes/instabilis	20440	8
AZ5	Balakanchay-Downstream	Azerbaijan	Insecta	Diptera	Chironomidae	Chironomus	4663	3
AZ5	Balakanchay-Downstream	Azerbaijan	Insecta	Ephemeroptera	Baetidae	Baetis niger	4410	4
AZ6	Ayrichay Mouth	Azerbaijan	Insecta	Trichoptera	Hydropsychidae	Hydropsyche siltalai	5604	7
AZ6	Ayrichay Mouth	Azerbaijan	Insecta	Ephemeroptera	Baetidae	Baetis alpinus	4381	2
AZ6	Ayrichay Mouth	Azerbaijan	Insecta	Diptera	Chironomidae	Chironomus	4663	4
AZ6	Ayrichay Mouth	Azerbaijan	Crustacea	Decapoda	Gammaridae	Paramysis lacustris	30006	6
AZ6	Ayrichay Mouth	Azerbaijan	Annelida	Oligochaeta	Lumbricidae	Lumbricus	5909	3
AZ7	Katekhchay near mouth	Azerbaijan	Insecta	Plecoptera	Perlidae	Perla marginata	6370	13
AZ7	Katekhchay near mouth	Azerbaijan	Insecta	Plecoptera	Chloroperlidae	Chloroperla	4671	4
AZ7	Katekhchay near mouth	Azerbaijan	Insecta	Ephemeroptera	Ephemerellidae	Ephemerella	5137	7
AZ7	Katekhchay near mouth	Azerbaijan	Insecta	Ephemeroptera	Heptageniidae	Epeorus	5119	10
AZ7	Katekhchay near mouth	Azerbaijan	Insecta	Diptera	Chironomidae	Chironomus	4663	8
AZ7	Katekhchay near mouth	Azerbaijan	Insecta	Diptera	Simuliidae	Simulium	6853	3
AZ7	Katekhchay near mouth	Azerbaijan	Insecta	Diptera	Empididae	Clinocera nigra	7323	12
AZ7	Katekhchay near mouth	Azerbaijan	Annelida	Hirudinea	Erpobdellidae	Erpobdella octacullata	5159	1
AZ8	Kurmukchay near mouth	Azerbaijan	Insecta	Ephemeroptera	Baetidae	Baetis rhodani	4415	7
AZ8	Kurmukchay near mouth	Azerbaijan	İnsecta	Ephemeroptera	Baetidae	Baetis alpinus	4381	5
AZ8	Kurmukchay near mouth	Azerbaijan	Insecta	Diptera	Chironomidae	Chironomus	4663	6
AZ8	Kurmukchay near mouth	Azerbaijan	Insecta	Diptera	Simuliidae	Simulium	6853	3
AZ8	Kurmukchay near mouth	Azerbaijan	Insecta	Diptera	Empididae	Clinocera nigra	7323	4
AZ8	Kurmukchay near mouth	Azerbaijan	Insecta	Diptera	Elmidae	Elmis	12072	1
AZ9	Talachay near mouth	Azerbaijan	Insecta	Ephemeroptera	Baetidae	Baetis rhodani	4415	11
AZ9	Talachay near mouth	Azerbaijan	Insecta	Ephemeroptera	Baetidae	Baetis fuscatus	4397	4
AZ9	Talachay near mouth	Azerbaijan	Insecta	Diptera	Chironomus	Chironomidae	4642	12
AZ9	Talachay near mouth	Azerbaijan	Insecta	Diptera	Simuliidae	Simulium	6853	13

Table 18: Taxa list of additional Georgian sites.

TB Code	Site Name	Country-Team	Major Group	Order	Family	Taxon name	AQEM code	Ind
GE5	Shromiskhevi-Lagodekhi	Georgia	Insecta	Ephemeroptera	Baetidae	Baetis sp.	4419	9
GE5	Shromiskhevi-Lagodekhi	Georgia	Insecta	Diptera	Chironomidae	Chironomidae Gen. sp.	4642	27
GE5	Shromiskhevi-Lagodekhi	Georgia	Insecta	Ephemeroptera	Heptageniidae	Epeorus sp.	5119	2
GE5	Shromiskhevi-Lagodekhi	Georgia	Crustacea	Amphipoda	Gammaridae	Gammarus sp.	5293	8
GE5	Shromiskhevi-Lagodekhi	Georgia	Insecta	Diptera	Limoniidae	Hexatoma sp.	5481	2
GE5	Shromiskhevi-Lagodekhi	Georgia	Insecta	Trichoptera	Hydropsychidae	Hydropsyche sp.	5605	16
GE5	Shromiskhevi-Lagodekhi	Georgia	Insecta	Plecoptera	Leuctridae	Leuctra sp.	5790	1
GE5	Shromiskhevi-Lagodekhi	Georgia	Insecta	Plecoptera	Perlidae	Perla sp.	6372	6
GE5	Shromiskhevi-Lagodekhi	Georgia	Insecta	Ephemeroptera	Heptageniidae	Rhithrogena sp.	6747	5
GE5	Shromiskhevi-Lagodekhi	Georgia	Insecta	Diptera	Simuliidae	Simulium sp.	6853	4
GE5	Shromiskhevi-Lagodekhi	Georgia	Annelida	Oligochaeta	Lumbricidae	Eiseniella tetraedra	5075	1
GE5	Shromiskhevi-Lagodekhi	Georgia	Mollusca	Gastropoda	Planorbidae	Gyraulus	5359	1
GE6	Alazani-Chiauri	Georgia	Insecta	Ephemeroptera	Caenidae	Caenis sp.	4528	1
GE6	Alazani-Chiauri	Georgia	Insecta	Diptera	Chironomidae	Chironomidae Gen. sp.	4642	1
GE6	Alazani-Chiauri	Georgia	Insecta	Odonata	Gomphidae	Gomphidae Gen. sp.	8410	1

Reviewer's Note:

Due to the very low number of benthic invertebrate individuals caught, it would not be reliable to use the data for calculating the ecological status. The AQEM method requires to count and identify at least 700 individuals out of the 20 sub-samples to gain a representative taxa composition. However, both teams sampled significantly lower amounts.

Interestingly, both teams came to similar results, but from the reviewer's point of view the reasons for this circumstance are unclear. In previous studies, both teams were able to catch a higher amounts of invertebrates, even if they often stayed below the required number of individuals.

Possible reasons for the low number of individuals:

- Methodological issues, either in sampling and/or lab work.
- Human pressures, although site descriptions and results of chemical and hydro-morphological analyses make this unlikely.
- Seasonal changes. As the sampling took place rather late during the year, a lot of animals would be juvenile and therefore very small. This might have lead to some individuals having been overlooked by national experts.
- Natural phenomena, e.g. a flood shortly before the sampling campaign can lead to temporarily decreased taxa density in affected areas.

5. Discussion of results

The studied rivers are low and normally mineralized waters with a range of electrical conductivity of 89.9 to 552 µsms/sm. Chemical results, indicate that more pollution was observed in the lower reaches of the rivers compared to the upper reaches. All measured values are within acceptable limits. Exceedance of maximum permissible concentrations of any component according to Georgian Law was not observed.

The differing results of both institutions show that further coordination between the two laboratories is required. It should also be noted that there can always be differences in the measurement results, the causes of which should be investigated.

Chemical analyses reach comparable values for a part of the investigated parameters, while others differ significantly. Reasons for this are unclear and no pattern between the laboratories was observed.

As for the biological results, the extremely low number of individuals and taxa of benthic invertebrates sampled during the survey by both sides raises a questions. The reasons may lie in either natural phenomena or methodological shortcomings. The requirement of the AQEM method to count and identify at least 700 individuals in each sample (if present) could not be fulfilled. This lowers the validity and significance of the biological data and therefore a calculation of the biological status based on these results cannot be considered reliable.

6. Lessons learned and recommendations

Continuous monitoring is important in studying environmental changes. The results of continuous monitoring carried out for many years provide a basis for a sound evaluation of the ecological status of ecosystems. Only through this assessment, it is possible to implement targeted protection and restoration measures and increase local ecosystem services to the benefit of society and nature.

Rivers do not end at borders and monitoring river basins extending beyond political boundaries is an important part of cooperation and working towards sustainable water resource management. The exercise of this transboundary survey between Azerbaijan and Georgia is in itself a remarkable achievement that should be built and improved on in the future.

The observed differences in results of this transboundary surface water survey underline the necessity to undertake similar exercises and surveys in order to increase reliability and trust in the results of each laboratory. In this light, the following recommendations are given on how both institutions (NEA and AzeLab) should work closely together to identify sources of errors, harmonize methods, and improve the comparability of results.

- It is advised to repeat this transboundary exercise with a more direct interaction and cooperation of the sampling and laboratory teams to mitigate possible different methodological approaches. If possible sampling and analysis should be done together and procedures harmonized.
- Ensure standardised sampling, sample stabilisation and sample transport in accordance with the ISO standards. Compliance with this will lead to an improvement in the comparability of the results. The efforts of the laboratories in the area of quality assurance, such as regular participation in round Proficiency Tests and comparative measurements, should also contribute to comparability.
- It is further recommended to participate in ring-tests whenever possible and to continue the transboundary activities and surveys to increase the credibility and comparability of future results.
- Future sampling campaigns should be conducted in late spring in order to investigate if the biological results are related to seasonal changes. Stable hydrological conditions should be present at least for a few weeks before the sampling campaign.
- Be sure to follow the biological methods (e.g. take required 20 sub samples) to increase the number of animals caught.
- The sampling team, lab experts and reporters should document and comment findings that are out of the ordinary (e.g. low taxa, low individual numbers). Make reference to possible local observations that could explain the circumstances. Compare to other sampling campaigns or research to undermine or question the findings.

7. Annexes

Annex A

Annex_A_AZ-GE_CHEM-Data.xlsx

Annex B

Annex_B_AZ-GE_MZB-Data.xlsx

7.1. Georgian Annexes

GE-Annex 1: Field protocols summary (in Excel format)

GE-Annex 2: Field protocols

GE-Annex 3: Hydro-morphological site description

GE-Annex 4: Chemical data summary (in Excel format)

GE-Annex 5: Protocol for sample handover

GE-Annex 6: Biological data summary (in Excel format)

GE-Annex 7: Photo documentation

GE-Annex 8: Metadata

7.2. Azeri Annexes

AZ-Annex 1: AQEM field protocols (in Excel format)

AZ-Annex 2: Chemical field protocols

AZ-Annex 3: Hydro-morphological site description

AZ-Annex 4: Chemical data summary (in Excel format)

AZ-Annex 5: MHS protocols scanned

AZ-Annex 6: Protocol for diatom sampling

AZ-Annex 7: Biological data summary (in Excel format)

AZ-Annex 8: Photo documentation

AZ-Annex 9: Metadata

Funded by the European Union

EU4Environment
Water and Data in Eastern Partner Countries

www.eu4waterdata.eu

Implementing partners

umweltbundesamt
ENVIRONMENT AGENCY AUSTRIA

Austrian Development Agency

OiEau International Office for Water

OECD
BETTER POLICIES FOR BETTER LIVES

UNECE

Co-funded by

With funding from
Austrian Development Cooperation

RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

AGENCE DE L'EAU