Action funded by the EUROPEAN UNION

EUWI+ EU WATER INITIATIVE FOR EASTERN PARTNERSHIP

European Union Water Initiative Plus for
Eastern Partnership Countries (EUWI+): Results 2 and 3

ENI/2016/372-403

SURFACE WATER SURVEY 2018 FIELD SURVEY OF MACROINVERTEBRATES IN 21 SITES WITHIN THE RIVER BASINS OF GANIKH AND KURA (UPSTREAM THE MINGACHEVIR DAM)

Version AZ-MENR-1; September 2019

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Imprint

Owner and Editor: EU Member State Consortium

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September 2019

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Abbreviations

BMO..... Basin Management Organization
CEPA..... Comprehensive and Enhanced Partnership Agreement
CORINE..... Coordination of Information on the Environment
DG NEAR ..... Directorate-General for Neighborhood and Enlargement Negotiations
DSS ..... Decision Support System
EC..... European Commission
ENI..... European Neighborhood Instrument
EU..... European Union
EUR ..... Euro
EEA..... European Environment Agency
ENP ..... European Neighborhood Policy
EUWI ..... European Union Water Initiative
GIS..... Geographic Information Systems
GWB ..... Groundwater Body
IWRM..... Integrated Water Resources Management
LTD ..... Limited Company
NGO..... Non-Governmental Organization
RBD ..... River Basin District
RBMP ..... River Basin Management Plan
SEIS..... Shared Environment Information System
USSR..... Union of the Soviet Socialistic Republics
WFD..... Water Framework Directive
WUA ..... Water Users' Association

1 EXECUTIVE SUMMARY

The support of the project “European Union Water Initiative Plus (EUWI+) for Eastern Partnership” includes various ongoing works in different fields of water management in Azerbaijan. This includes harmonization between national legislation and methodologies and EU requirements, in particular related to the EU Water Framework Directive (WFD). A key issue of WFD is the application of a basin approach for better planning and management of the river basin areas.

River Basin Management Plans (RBMP) are required planning tools that give the overall orientation for water management in the basin, notably the objectives to be reached and the priorities in the actions to be developed. In Azerbaijan, the River Basin sub-District (RBD) of the Kura upstream of the Mingachevir Dam has been selected as pilot area for the EUWI+ project.

The objective of this contract was to carry out an ecological survey in 21 sampling sites in Azerbaijan, which includes field protocols, water and sediment sampling, chemical and biological analysis and the hydro-morphological description of the sampling sites.

The field survey was successfully carried out between 1st and 6th of October 2018 at 21 sites from 15 different rivers of the RBD Kura upstream of the Mingachevir Dam. At each site 14 general physico-chemical parameters and 6 metals were analysed. The biological community was analysed from alls sites, but no specimens were found in samples from five sites, which were extremely turbid during the sampling.

In total, 34 taxa of benthic invertebrates from 28 different families and 9 orders were identified. The data provide an important data base for the evaluation of existing or the development of new assessment methods.

2 INTRODUCTION AND SCOPE

The objective of the survey in autumn 2018 was to form a sound methodological basis for future monitoring programms as essential part of river basin management planning.

The scope was to

- Train the experts on sampling and hydro-morphological site description;
- Provide data for the evaluation of the water body delineation;
- Provide data for the evaluation of the monitoring design in preparation of further surveys in 2019;
- Provide data for the pressure-impact assessment in order to evaluate existing assessment methods or develop new ones;
- Create a data base for the upcoming risk, status and trend assessment

Table 1: General data of the survey in autumn 2018

Country	Azerbaijan
River basin	RBD Kura upstream of the Mingachevir dam • sub-basin Ganikh river • sub-basin Kura
Campaign [1)]	Autumn 2018
Objective	• Collecting data for the evaluation of existing or development of new assessment methods for benthic invertebrates • Providing a data base for the definition of reference conditions for benthic invertebrates in selected river types
Quality elements	Biological quality components: **X Macrozoobenthos** ☐ Phytobenthos Supporting elements: **X Hydro-morphological site desription** **X General physico-chemical quality elements**
Field work	01.–0.10.2018
Chemical analyses	08.–22.10.2018
Biological analyses	08.10.2018–10.11.2018

3 METHODS

3.1 Selected pilot river basins and sampling sites

The following tables list the sampling sites with basic information on geographical coordinates, HMWB status, risk assessment and significant pressures (Table 2 & Figure 1: Sampling sites during the field survey in autumn 2018.

Table 3). Detailed information on altitude, catchment area and geology are given in the Annex.

Table 2: List of sampling sites with geographical coordinates.

River	Site	WB	Nr	Site code	Latitude	Longitude
KURA RIVER SYSTEM						
Shamkirchay	Chinarli	Kur013-6-WB023	1	SW005	40° 46.969’	46° 6.472’
Zayamchay	Yanigli	Kur014-2-WB028	2	SW007	40° 45’ 25.7”	45° 40’ 20.7”
Zayamchay	Kohnagala	Kur014-3-WB030	3	SW006	40° 52’ 36.5”	45° 45’ 44.2”
Joqaschay	Alpout	Kur0161-2-WB042	4	SW011	41° 4’ 45.4”	45° 12’ 13.1”
Akstafachay	below Jogazchay mouth	Kur016-3-WB043	5	SW010	41° 6’ 0”	45° 22’ 0”
Tovuzchay	Below Tovuz	Kur015-3-WB034	6	SW008	40° 59’ 0”	45° 39’ 0”
Akhinjachay	Oysuzlu	Kur0151-1-WB033	7	SW009	40° 56’ 51.9”	45° 34’ 45.2”
Qoshqar-chay	Yalgishlag	Kur012-2-WB011	8	SW004	40° 34’ 0”	46° 10’ 0”
Qoshqar-chay	Metfactory	Kur012-3-WB013	9	SW003	40° 34’ 0”	46° 10’ 0”
Ganjachay	Zurnabad	Kur011-2-WB004	10	SW001	40° 29’ 0”	46° 14’ 0”
Ganjachay	Below Ganja	Kur011-5-WB007	11	SW002	40° 36’ 0”	46° 19’ 0”
GANIKH RIVER SYSTEM						
Balakenchay	Upstream of Belokan	Gan107-1-WB042	12	SW021	41° 43.59’	46° 25.817’
Katekhchay	Katekh	Gan106-2-WB039	13	SW020	41° 38.374’	46° 33.810’
Talachay	Meshlesh (Upper Zagatala city)	Gan1051-1-WB034	14	SW017	41° 38.927’	46° 42.729’
Talachay	Below Zagatala	Gan1051-2-WB035	15	SW018	41° 37.365’	46° 38.751’
Karachay	High way	Gan104-3-WB031	16	SW016	41° 27’ 0”	46° 40’ 0”
Ayrichay	below Ayrichay reservoir	Gan101-4-WB015	17	SW013	41° 14.333’	46° 54.586’
Kurmukhchay	Almaly (below Gakh)	Gan102-3-WB021	18	SW015	41° 19’ 0”	46° 47’ 0”
Kurmukhchay	near Gakh	Gan102-2-WB020	19	SW014	41° 2’ 70”	47° 1’ 0”

River	Site	WB	Nr	Site code	Latitude	Longitude
Kishchay	upper Sheki city	Gan1013-1-WB008	20	SW019	41° 15.399’	47° 12.876’
Ayrichay	Bash Dashagil	Gan1011-1-WB002	21	SW012	41° 5’ 0”	47° 21’ 0”

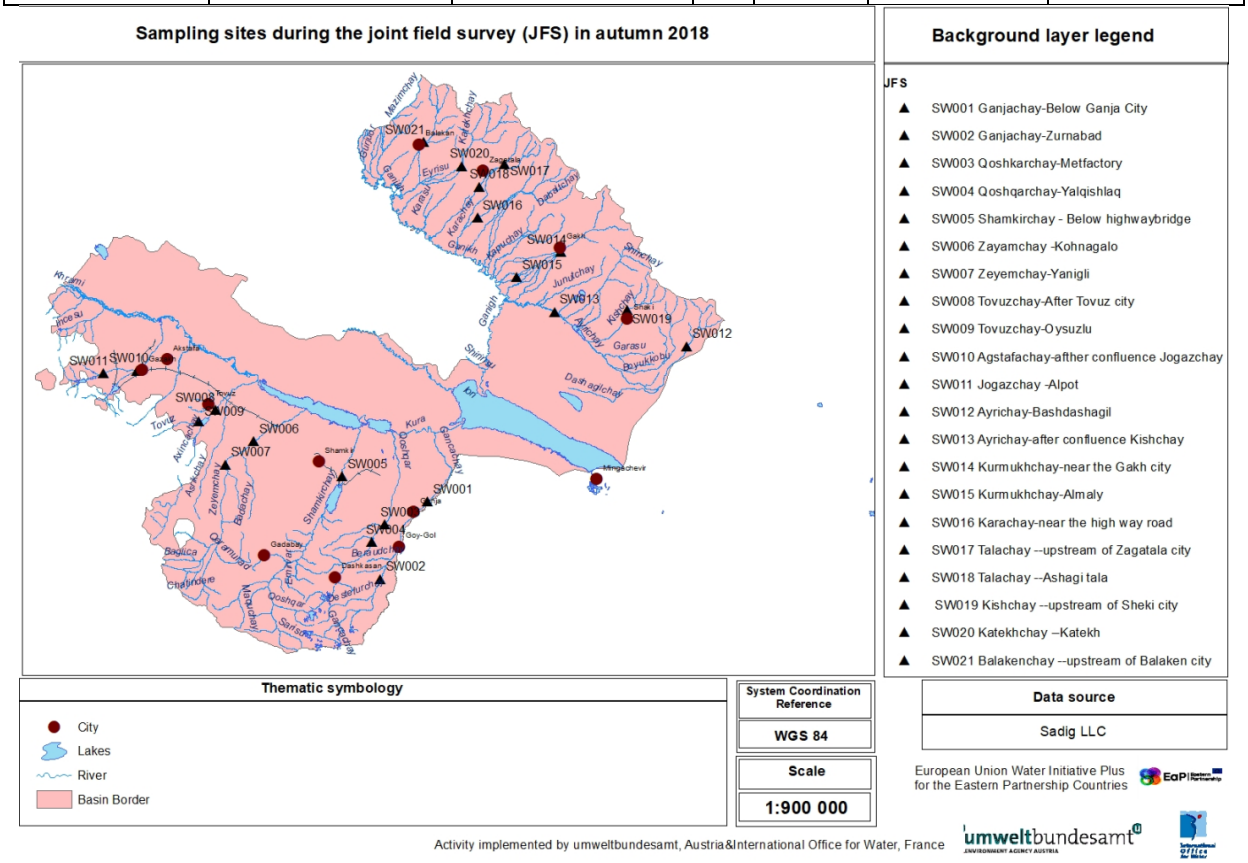

Figure 1: Sampling sites during the field survey in autumn 2018.

Table 3: List of sampling sites with HMWB status, risk assessment (N = no risk, R = at risk, PR = possibly at risk, cHMWB = candidate heavily modified water body) and significant pressures (1 = weak, 2 = mod, 3 = significant pressure).

River & Site Name	SWB Code	Point sources	Diffuse agr	Diffuse livestock	Final score	Risk	JFS 2018
KURA RIVER SYSTEM							
Shamkirchay Chinarli	Kur013-6-WB023	2	2	2	2	PR	SW005
Zayamchay Yanigli	Kur014-2-WB028	1	1	1	1	N	SW007
Zayamchay Kohnagala	Kur014-3-WB030	3	3	3	3	R	SW006
Joqaschay Alpout	Kur0161-2-WB042	2	2	2	2	PR	SW011
Akstafachay below Jogazchay mouth	Kur016-3-WB043	3	3	3	3	R	SW010
Tovuzchay Below Tovuz	Kur015-3-WB034	2	2	2	2	R	SW008
Akhinjachay Oysuzlu	Kur0151-1-WB033	3	3	3	3	R	SW009

River & Site Name	SWB Code	Point sources	Diffuse agr	Diffuse livestock	Final score	Risk	JFS 2018
Qoshqarchay Yalgishlag	Kur012-2-WB011	2	2	3	3	R	SW004
Qoshqarchay Metfactory	Kur012-3-WB013	3	3	3	3	R	SW003
Ganjachay Zurnabad	Kur011-2-WB004	3	3	3	3	cHMWB	SW001
Ganjachay Below Ganja	Kur011-5-WB007	1	1	1	1	N	SW002
GANIKH RIVER SYSTEM							
Balakenchay Upstream of Belokan	Gan107-1-WB042	2	3	3	3	R	SW021
Katekhchay Katekh	Gan106-2-WB039	1	1	1	1	N	SW020
Tlachay Meshlesh (Upper Zagatala city)	Gan1051-1-WB034	1	1	1	1	N	SW017
Tlachay Below Zagatala	Gan1051-2-WB035	2	3	3	3	R	SW018
Karachay High way	Gan104-3-WB031	2	2	2	2	PR	SW016
Ayrichay below Ayrichay reservoir	Gan101-4-WB015	3	3	3	3	R	SW013
Kurmukhchay Almaly (below Gakh)	Gan102-3-WB021	3	3	3	3	R	SW015
Kurmukhchay near Gakh	Gan102-2-WB020	2	2	2	2	PR	SW014
Kishchay upper Sheki city	Gan1013-1-WB008	1	1	1	1	N	SW019
Ayrichay Bash Dashagil	Gan1011-1-WB002	1	1	1	1	N	SW012

3.2 Sampling period

The sampling dates and team as well as the general meteorological and hydrological conditions are briefly described in

Table 4.

Table 4: Sampling dates and information on meteorological and hydrological conditions.

River & Site Name	SWB Code	Date	TEAM	Met	Hyd	JFS 2018
KURA RIVER SYSTEM						
Shamkirchay Chinarli	Kur013-6-WB023	01.10.2018	RV,VI,AV,AA,GG,MA,ZH	dry	medium	SW005
Zayamchay Yanigli	Kur014-2-WB028	01.10.2018	RV,VI,AV,AA,GG,MA,ZH	dry	low	SW007
Zayamchay Kohnagala	Kur014-3-WB030	01.10.2018	RV,VI,AV,AA,GG,MA,ZH	dry	medium	SW006
Joqaschay Alpout	Kur0161-2-WB042	02.10.2018	RV,VI,AV,AA,GG,MA,ZH	dry	low	SW011
Akstafachay below Jogazchay mouth	Kur016-3-WB043	02.10.2018	RV,VI,AV,AA,GG,MA,ZH	dry	medium	SW010
Tovuzchay Below Tovuz	Kur015-3-WB034	02.10.2018	RV,VI,AV,AA,GG,MA,ZH	dry	medium	SW008
Akhinjachay Oysuzlu	Kur0151-1-WB033	01.10.2018	RV,VI,AV,AA,GG,MA,ZH	dry	low	SW009
Qoshqarchay Yalgishlag	Kur012-2-WB011	03.10.2018	RV,VI,AV,AA,GG,MA,ZH	dry	medium	SW004
Qoshqarchay Metfactory	Kur012-3-WB013	03.10.2018	RV,VI,AV,AA,GG,MA,ZH	dry	high	SW003
Ganjachay Zurnabad	Kur011-2-WB004	03.10.2018	RV,VI,AV,AA,GG,MA,ZH	dry	low	SW001
Ganjachay Below Ganja	Kur011-5-WB007	03.10.2018	RV,VI,AV,AA,GG,MA,ZH	rainy	medium	SW002
GANIKH RIVER SYSTEM						
Balakenchay Upstream of Belokan	Gan107-1-WB042	04.10.2018	VI,AV,AA,GG,MA	dry	low	SW021
Katekhchay Katekh	Gan106-2-WB039	04.10.2018	VI,AV,AA,GG,MA	dry	medium	SW020
Talachay Meshlesh (Upper Zagatala city)	Gan1051-1-WB034	04.10.2018	VI,AV,AA,GG,MA	dry	medium	SW017
Talachay Below Zagatala	Gan1051-2-WB035	04.10.2018	VI,AV,AA,GG,MA	dry	high	SW018
Karachay High way	Gan104-3-WB031	05.10.2018	VI,AV,AA,GG,MA	dry	low	SW016
Ayrichay below Ayrichay reservoir	Gan101-4-WB015	06.10.2018	VI,AV,AA,GG,MA	dry	medium	SW013
Kurmukhchay Almaly (below Gakh)	Gan102-3-WB021	05.10.2018	VI,AV,AA,GG,MA	dry	medium	SW015
Kurmukhchay near Gakh	Gan102-2-WB020	05.10.2018	VI,AV,AA,GG,MA	dry	high	SW014
Kishchay upper Sheki city	Gan1013-1-WB008	06.10.2018	VI,AV,AA,GG,MA	dry	high	SW019
Ayrichay Bash Dashagil	Gan1011-1-WB002	06.10.2018	VI,AV,AA,GG,MA	dry	high	SW012

3.3 Quality elements

Three quality elements have been chosen:

- Macroinvertebrates (= macrozoobenthos) as biological quality element;
- General physico-chemical parameters (no specific relevant pollutants such as heavy metals), list of parameters see Table 5:
- Hydromorphology for site description

Table 5: Parameters analyzed in the field and in the laboratory.

Parameter	Unit
Field measurements	
Water temperature (WT)	°C
Oxygen concentration (DO)	mg/L
Oxygen saturation (O_2-Sat)	%
pH	
Electric conductivity (EC)	µS/cm
Laboratory analyses	
Water temperature (WT, lab control)	°C
Transparency (Tr)	m
Oxygen concentration (DO, lab control)	mg/L
Oxygen saturation (O_2-Sat, lab control)	%
pH (lab control)	
Electric conductivity (EC, lab control)	µS/cm
Biological oxygen demand (BOD_5)	mg/L
Chemical oxygen demand ($K_2Cr_2O_7$) (COD)	mg/L
Ammonia-N (NH_4-N)	mg/L
Nitrate-N (NO_3-N)	mg/L
Orthophosphate, as P (PO_4-P)	mg/L
Chloride (Cl)	mg/L
Sulphate, total ion (SO_4)	mg/L
Arsenic (As)	µg/L
Cadmium (Cd)	µg/L
Cupper (Cu)	µg/L
Nickel (Ni)	µg/L
Lead (Pb)	µg/L
Zinc (Zn)	µg/L

3.4 Responsibilities

Responsibilities for field work, laboratory analyses and reporting as well as the overall responsibility of the survey are summarised in Table 6

Table 6: .

Table 6: Responsible institutions and persons in preparation and during the survey.

Responsibilities	Institution, contact person, email-address
General	
Responsible for the organisation of surface water body sampling	Institute: Laboratory Center Contact person: Ramina Abdullayeva E-Mail: abdullayevaramina@gmail.com
Field work	
Responsible for field work (biological and chemical sampling, hydro-morphological site description)	Institute: Laboratory Center Contact person: Gunel Gurbanova, Ayten Aliyeva and Asif Verdiyev UBA expert: Zornig Horst Supporting person(s): Rafig Verdiyev E-Mail: rafig2000@mail.ru
Responsible for functional check of sampling equipment	Institute: Laboratory Center Contact person: Ramina Abdullayeva E-Mail: abdullayevaramina@gmail.com
Responsible for calibration of on-site measuring equipment	Institute: Laboratory Center Contact person: Ayten Aliyeva E-Mail: ayte1983@mail.ru
Chemical analysis	
Overall responsible for the chemical analysis in the lab, including reporting and data delivery	Institute: Laboratory Center Contact person: Ayten Aliyeva E-Mail: ayte1983@mail.ru
Responsible for sample transport from the field to the laboratory	Institute: Global eco Contact person: Nicat Guliyev E-Mail: cavidan07@mail.ru
Analysing laboratory and contact person	Institute: Laboratory Center, National Environmental monitoring Department, Ministry of Ecology and Natural Resources of Azerbaijan Republic Contact person: Ramina Abdullayeva E-Mail: abdullayevaramina@gmail.com
Biological analysis	
Overall responsible for the biological analysis in the lab, including reporting and data delivery	Institute: Laboratory Center Contact person: Gunel Gurbanova E-Mail: gunel-qurbanova-90@mail.ru

4 METHODS

4.1 Chemical analyses

4.1.1 Field parameters and transport

At each site the following parameters were measured: pH, electric conductivity, water temperature, dissolved oxygen and oxygen saturation. Chemical analyses of other parameters were carried out in the laboratory (see below).

Samples were preserved separately at the site in accordance with the ISO standard cooled at 4 °C where it was necessary and transported to the laboratory.

4.1.2 Receipt of samples in the Laboratory

Samples were received in the Laboratory by the analyst, which is, in this case, also the sample custodian. The sample custodian received the samples in the sample storage room and first of all carried out a qualitative check of each sample and of the accompanying documents, as for example:

- The integrity of the sample (well packed, the whole quantity inscribed in the sample protocols);
- The integrity of the label and of the information written on the label;
- The concordance of the information written on the label and the information recorded in the sampling protocols.

The protocols for sample delivery and handover are presented in Annex 5.

4.1.3 Handling of samples

During the period of pre-treatment of the samples and the performance of the tests, samples were handled in accordance with the instructions from the test method and the specific SOPs. In order to maintain integrity of the samples, long periods of keeping the sample in the laboratory are avoided. At the same time, samples were kept in proper condition of temperature and humidity.

Before the analyses were done the measurement and test equipment was calibrated internally by the laboratory staff.

4.1.4 Overview of analysed parameters

Analyses of the samples were done in accordance with the ISO standards and the appropriate SOP's which are implemented in the laboratory. A list of methods is given in the Table 7.

The parameters water temperature (WT), transparency (Tr), dissolved oxygen (DO), oxygen saturation (O_2-sat), pH and electric conductivity (EC) were analysed both in the field and in the laboratory. The other parameters were analysed in the chemical laboratory between 9th and 20th of October 2018.

Table 7: List of analysed parameters and analytical methods.

Ions		MAC	Method	Standard
Transparency	m		Organoleptic	ISO 7027
Colour	–		Organoleptic	ISO 7887
Smell	–		Organoleptic	ISO 4121
pH	–		Potentiometer	ISO 10523
Oxygen concentration & saturation	mg/l, %		Electro-chemical	ISO 5814
Electric conductivity	µS/cm		Conductometer	ISO 7888
Biological oxygen demand BOD_5	mg/l		Electro-chemical	ISO 5815
Chemical oxygen demand COD_5	mg/l		Electro-chemical	ISO 6060
Chloride Cl	mg/l	350.0	Titrimetric	ISO 9297
Nitrate NO_3	mg/l	45	Spectrometric	ISO 7890-3
Ammonium NH_4	mg/l		Spectrometric	ISO 6777
Phosphate PO_4	mg/l		Spectrometric	ISO 6878
Sulphate SO_4	mg/l	500.0	Titrimetric	ISO 9280
Heavy metals				
Arsenic As	µg/l	50	AAS	ISO 12020
Lead Pb	µg/l	30	AAS	ISO 12020
Cadmium Cd	µg/l	1	AAS	ISO 12020
Copper Cu	µg/l	1	AAS	ISO 12020
Nickel Ni	µg/l	100	AAS	ISO 12020
Zinc Zn	µg/l	500	AAS	ISO 12020

MAC = maximum allowable concentration

4.1.5 QA/QC

Sampling AQC's were made in accordance with the contract (contractor demand).

The laboratory uses reference materials. All Standard solutions were prepared from reference materials which are labeled with the date of preparation, expiry date and the name of person that prepared the solution. These solutions are kept in conditions specified in the test method.

4.2 Problems, difficulties and deviation from the work plan

- Changes of sampling sites
- GPS device was not calibrated
- There were no bottles specially designed for the BOD_5 samples
- In some rivers flooding increased turbidity, in some others (downstream) a strong water abstraction created problems for measurements

4.3 Biological analyses

4.3.1 Field work

Field work followed the using the multi-habitat sampling (MHS) method as defined by the EU projects AQEM/STAR and described in the Survey Manual (version September 2018). At each site 20 sub-samples or replicates were taken from different habitats (= choriotopes) and from all types of bottom substrates available, such as rock, gravel, vegetation, large and fine sediments. Each replictae represents a minimum areal proportion of 5%. Habitats with <5% areal proportion were not sampled. The habitats were documented in the AQEM/STAR template as prepared during the training prior to the survey

Sampling of bottom sediment was carried out by setting down the MHS net downstream of the choriotope, which was then stirred up to allow fine sediment and animals drifting into the net. The projected area of each choriotope was 25 x 25 cm, the total sampling area was 1.25 m^2.

Samples of macro invertebrates were taken up to a depth where wading was is possible. Specimens are taken in large and deep rivers in accordance with EN ISO 9391 and EN 28265, and from shallow rives and rivers with stone bottom in accordance with EN 28265.

At five sites, turbidity was extremely high. It turned out in the lab that no animals could be found in the samples. It is unclear whether this is a natural feature of these rivers or river stretches and thus should be considered for typology and defining the type-specific reference conditions, or if this resulted from unknown human impact.

4.3.2 Laboratory analyses

The samples were brought to the laboratory, where macroinvertebrates were cleaned and prepared for the analysis. For each sample, the taxonomic class, major group and where possible the genus or species was specified. After the determination the specimens were stored in special glass containers in ethyl alcohol.

Specific atlas and reference books were used for the determination of macroinvertebrates by species:

1. V.A. Dogelin «Onurğasızlar zoologiyası»
2. Benthic macroinvertebrates general information on sampling, selection of representative locality, equipment and devices, microhabitats, assessment (Traning course April 24, 2012- Tbilisi, Georgia)
3. Hidrobiologiya F.Q. Ağamalıyev, İ. Ə. Süleymanova Bakı-2010
4. Определитель пресновомных беспрзвоночных Европейсской части СССР. Ленинград, 1977
5. Разнообразие Водных Экосистем М.В.Чертопруд Москва 2005 г

5 RESULTS

5.1 Field protocols and hydro-morphological site description

The field protocols are provided as separate attachment in Annex 1a (Scans) and 1b (Excel format).

The photos are provided as JPG as separate files in the folder Annex 2.

The hydro-morphological site description is provided as separate attachments (Annex 3).

5.2 Chemical analyses

The results of the physico-chemical analyses are summarised in

and additionally provided in Excel format as Annex 4.

Sample handover protocols are given in Annex 5.

Table 8: Results of the chemical analyses from 21 sampling sites in autumn 2018. Abbreviation of parameters see chapter 4.1.4.

Nr	River	WB Code	Sites	Date	WT °C	Tr cm	DO mg/L	O_2 %	pH	EC
1	Shamkirchay Chinarli	Kur013-6-WB023	SW005	01.10.2018	18.0	28	8.7	89.0	8.0	438
2	Zayamchay Yanigli	Kur014-2-WB028	SW007	01.10.2018	19.4	26	9.1	93.5	8.4	355
3	Zayamchay Kohnagala	Kur014-3-WB030	SW006	01.10.2018	19.9	27	7.3	76.9	8.5	349
4	Joqaschay Alpout	Kur0161-2-WB042	SW011	02.10.2018	20.2	28	8.6	90.1	8.3	555
5	Akstafachay below Jogazchay mouth	Kur016-3-WB043	SW010	02.10.2018	22.7	29	6.9	74.4	8.1	874
6	Tovuzchay Below Tovuz	Kur015-3-WB034	SW008	02.10.2018	20.3	27	7.1	73.6	8.3	953
7	Akhinjachay Oysuzlu	Kur0151-1-WB033	SW009	02.10.2018	18.7	28	7.8	82.5	8.0	1320
8	Qoshqarchay Yalgishlag	Kur012-2-WB011	SW004	03.10.2018	14.6	27	7.1	73.7	8.7	438
9	Qoshqarchay Metfactory	Kur012-3-WB013	SW003	03.10.2018	19.6	25	6.4	68.5	8.3	795
10	Ganjachay Zurnabad	Kur011-2-WB004	SW001	03.10.2018	15.0	26	8.7	92.4	8.6	291
11	Ganjachay Below Ganja	Kur011-5-WB007	SW002	03.10.2018	22.6	26	8.5	87.6	8.3	610
12	Balakenchay Upstream of Belokan	Gan107-1-WB042	SW021	04.10.2018	14.6	7	7.6	78.5	7.9	292
13	Katekhchay Katekh	Gan106-2-WB039	SW020	04.10.2018	17.4	27	6.7	71.2	8.0	727
14	Tlachay Meshlesh (Upper Zagatala city)	Gan1051-1-WB034	SW017	04.10.2018	17.8	1	7.4	77.6	8.3	383
15	Tlachay Below Zagatala	Gan1051-2-WB035	SW018	04.10.2018	22.5	1	7.0	73.2	8.2	368
16	Karachay High way	Gan104-3-WB031	SW016	05.10.2018	22.7	6	7.1	74.6	8.3	544
17	Ayrichay below Ayrichay reservoir	Gan101-4-WB015	SW013	06.10.2018	22.1	14	7.2	76.8	8.2	488
18	Kurmukhchay Almaly (below Gakh)	Gan102-3-WB021	SW015	05.10.2018	24.6	4	6.6	69.1	7.9	520
19	Kurmukhchay near Gakh	Gan102-2-WB020	SW014	05.10.2018	16.6	17	6.5	68.3	8.4	504
20	Kishchay upper Sheki city	Gan1013-1-WB008	SW019	06.10.2018	12.3	11	7.5	80.2	8.4	275

Nr	River	WB Code	Sites	Date	WT °C	Tr cm	DO mg/L	O_2 %	pH	EC
21	Ayrichay Bash Dashagil	Gan1011-1-WB002	SW012	06.10.2018	15.4	6	7.1	74.5	8.2	351

- *Continued.*

Nr	BOD_5 mg/l	COD mg/l	NH_4-N mg/l	NO_3-N mg/l	PO_4 mg/l	Cl mg/l	SO_4 mg/l	As µg/l	Cd µg/l	Cu µg/l	Ni µg/l	Pb µg/l	Zn µg/l
1	0.8	27.4	0,06	0,50	0.02	7.98	85.2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
2	0.9	15.3	0,15	0,81	0,03	9,57	67,8	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
3	0.9	14.2	0,11	0,73	0.03	8.86	59.0	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
4	1.0	20.3	0,17	0,35	0,02	37.75	92,3	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
5	1.1	24.7	0,23	0,39	0,04	56.54	147.1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
6	1.1	29.5	0,05	0,42	0,03	40.41	158.5	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
7	1.7	30.1	0,31	0,98	0,01	44.31	219.5	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
8	1.0	18.8	0,10	0,97	0,06	14.89	79.9	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
9	1.3	32.3	0,18	0,45	0,03	18.97	113.2	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
10	0.9	13.8	0,25	0,83	0,01	5.32	50.4	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
11	1.2	23.7	0.37	0.51	0.01	17.7	118.6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
12	0.6	15.4	0.20	0.19	0.01	5.3	53.7	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
13	1.6	27.6	0.04	0.33	0.02	92.20	120.9	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
14	1.2	8.7	0.05	0.15	0.01	10.64	63.9	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
15	0.9	8.5	0.07	0.11	0.01	12.41	60.7	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
16	0.8	21.1	0.03	0.22	0.03	3.55	92.6	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
17	1.2	19.7	0.09	0.31	0.01	11.52	87.1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
18	0.7	27.1	0.07	0.14	0.02	4.43	90.5	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
19	0.7	22.4	0.09	0.16	0.02	3.90	79.9	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
20	1.1	9.7	0.09	0.23	0.02	5.85	43.1	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
21	1.0	11.0	0.11	0.26	0.01	4.43	62.4	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
LOD			0.09	0.01	0.003	0.1	1	2	2	2	2	2	2

5.3 Biological analyses

The MHS protocols are provided as separate attachments in Annex 6 (Excel format). The biologial raw data are provided as Annex 7 (see ToR 1.4.4 & 1.4.5).

No animals were found in samples from site no. 12 (Balakenchay / upstream of Belokan), 13 (Katekhchay / Katekh), 14 (Talachay / Meshlesh Upper Zagatala city), 20 (Kishchay Upper Sheki city) and 21 (Ayrichay Bash Dashagil). It is unclear whether this is a natural feature of these rivers. After all, in samples from two other sites from Talachay (No. 15, Below Zagatala) and Ayrichay (No. 17, Below Ayrichay reservoir) we could find benthic invertebrates. This issue should be clarified in the future.

During the analyses of the biological samples, 34 taxa of benthic invertebrates were identified. They belong to 27 different families and 9 orders (Table 9). For most taxa matching AQEM codes were found from https://www.freshwaterecology.info/. A few exceptions revealed probable mis-identifications which might be due to inappropriate identification literature (e.g. from North-America).

Table 9: Taxa list of benthic invertebrates

Major group	Family	Genus/species	AQEM code
Oligochaeta	Lumbriculidae	*Lumbriculus* sp.	5906
Hirudinea	Erpobdellidae	*Dina lineata*	4973
Amphipoda	Gammaridae	*Gammarus* sp.	5293
Decapoda	Portunidae	*Carcinus maenas*	20390
Ephemeroptera	Baetidae	*Baetis* sp.	4419
	Caenidae	*Caenis* sp.	4528
	Ephemeridae	*Ephemera vulgata*	5129
	Heptageniidae	*Ecdyonurus* sp.	5053
	Heptageniidae	*Epeorus* sp.	5119
Odonata	Coenagrionidae	*Enallagma* sp.	8971
	Gomphidae	*Gomphus vulgatissimus*	5332
		Ophiogomphus sp.	9120
	Lestidae	*Lestes* sp.	5736
Plecoptera	Chloroperlidae	*Chloroperla* sp.	4671
	Perlodidae	*Isoperla* sp.	5673
Coleoptera	Elmidae	*Elmidae*	78470
	Gyrinidae	*Gyrinus* sp.	75364
	Haliplidae	*Brychius* sp.	74499
	Haliplidae	*Haliplus* sp.	75396
Trichoptera	Hydropsychidae	*Hydropsyche* sp.	5605
	Limnephilidae	*Limnephilus* sp.	5844
	Polycentropodidae	*Polycentropus* sp.	6472
Diptera	Blephariceridae	*Blepharicera* sp.	4464
	Empididae	*Clinocera nigra*	7323
	Limoniidae	*Hexatoma* sp.	5481
		Symplecta sp.	13285
	Muscidae	*Limnophora riparia*	5871
	Pediciidae	*Dicranota* sp.	4955
	Simuliidae	*Simulium* sp.	6853
	Tabanidae	*Tabanus* sp.	6963
	Tipulidae	*Prionocera* sp.	10341
		Tipula sp.	7077
		Tipula saginata	14317
	Chironomidae	*Chironomus* sp.	4663

6 CONCLUSIONS AND LESSONS LEARNED

- Site numbers / codes / names should be better harmonised
- Some parameters of ToR not analysed (Ca, Mg, Na, K, DP, TP, TSS, ANC), others were analysed but not covered by the ToR (heavy metals)
- All field work could be done with sufficient respect of personal safety, especially during the sampling of water and sediment in deep and fast-flowing river sections or at unstable sediment and riverbanks.
- As there is long distance from Central Kura to Ganikh basin and travel time is long therefore maybe is a need to arrange two separate JFS, with some time break between them
- There was also a problem with changing of sites because of low flow in some small rivers resulted from water abstraction
- Calibrated and appropriate equipment for field measurements should be improved, such as GPS device with photo camera; combined temperature, conductivity, oxygen and pH device
- During biological sampling filling of visual bio-monitoring template takes a lot of time, which can be simplified in the future (taking small note or schematic drawing etc.)
- The number of sites can be 2 or maximum 3 per day otherwise depending of distance and relied, weather and road quality we spend sometimes 10–12 hours in field during the day.
- The status of sites/rivers with bextremely high turbidity should be checked. It is unclear whether this is a natural feature of these rivers or river stretches and thus should be considered for typology and defining the type-specific reference conditions, or if this resulted from unknown human impact.

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8 ANNEXES

Annex 1 Field protocols

See separate attachment (scans of original protocols and summary format in Excel)

Annex 2 Photo documentation

See separate attachment (JPG format files)

Annex 3 Hydro-morphological site description

See separate attachment

Annex 4 Chemical data

See separate attachment

Annex 5 protocols for sample delivery and handover

See separate attachment

Annex 6 MHS field tables (AQEM-STAR protocols)

See separate document (Excel format)

Annex 7 Biological data

See separate document (Excel format)

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