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Benthic and fish fauna for pollution classification in the Natanebi river, west Georgia

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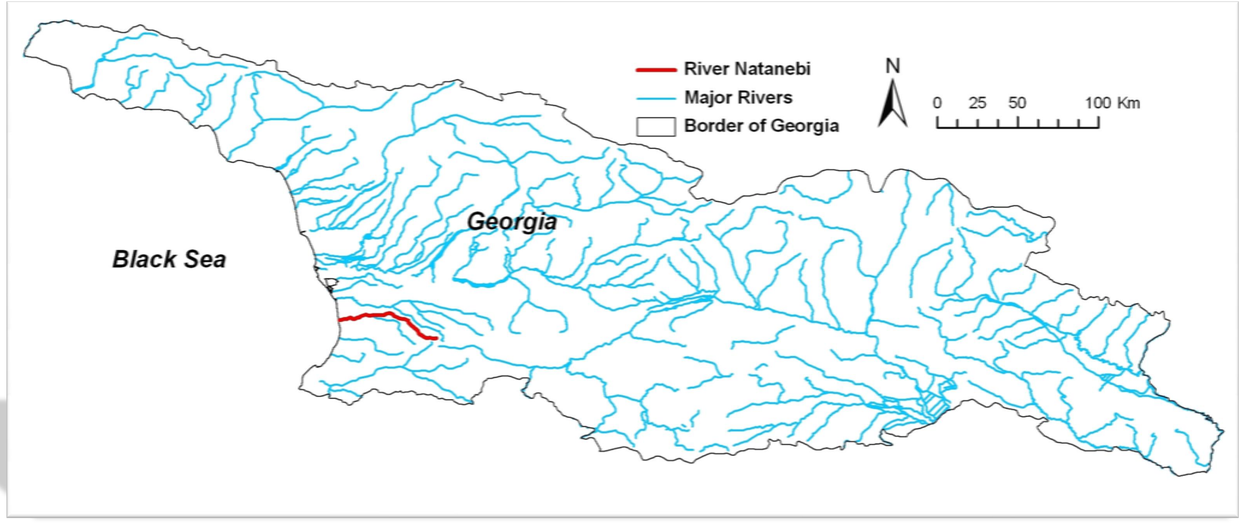
Introduction

At present, update information on aquatic biodiversity is largely unknown for most rivers in Georgia, while a comprehensive understanding of present-day species-environment relationships is limited. The Natanebi River is located in western Georgia, 42° 21′ 30″ N, 42° 29′ 0″ E, it is a tributary to the Black Sea and known to be an important spawning area for Black Sea salmonids. The river basin has been designated a formal protection status under Georgian law, which limits fisheries, despite this the river is polluted and disturbed by local communities and small industries. The aim of present study was to complete a preliminary assessment of the benthos and fish fauna in the Natanebi River and analyze the response of faunal composition along the gradient of human disturbance (pollution, grazing, etc.).

Material and methods

Three locations with different levels of anthropogenic pressures were sampled in different seasons during 2012 in order to (1) describe fish and benthic fauna and to (2) link fauna composition with different levels of disturbance. The first site was near the upstream of the river (undisturbed area), the 2nd near to village with a fish farm and grazing area (central basin), and the 3rd near to gravel excavation site and dams (downstream). For sampling of macro-invertebrate we used the kick net approach. At each site 6 sub-samples where taken. For fish sampling hand net and fishing rod were used. To complete the fish inventory, information from local fishermen also was collected. Samples were fixed in 70% ethanol. Identification at order level and specimen-count was executed in the laboratory by means of a microscope. Simultaneously water samples were taken and 15 chemical water parameters were analyzed.



Map of Georgia and the location of Natanebi River

Natanebi River

Fish species caught		
1	Chub	*Squalius cephalus* (Linnaeus, 1758)
2	Vimba bream	*Vimba vimba* (Linnaeus, 1758)
3	Colchic nase	*Chondrostoma colchicum* Derjugin, 1899
4	Caucasian gudgeon	*Gobio lepidolaemus caucasica* Kamensky, 1901
5	Colchic bitterling	*Rhodeus colchicus* Bogutskaya&Komlev, 2001
6	South minnow	*Alburnoides fasciatus* (Nordmann, 1840)
7	Batumi shemaya	*Chalcalburnus chalcoides derjugini* (Berg, 1923)
8	Pike	*Esox lucius* Linnaeus, 1758
9	Trout	*Salmo trutta fario* Linnaeus, 1758
10	Caucasian river goby	*Neogobius constructor* (Nordmann, 1840)

Results of chemical water quality analyses

Season	June			August			September		
Parameter \ Site	**I**	**II**	**III**	**I**	**II**	**III**	**I**	**II**	**III**
Temperature (ºC)	12	16	22	14.5	20.5	21	6	14	9
pH	7.9	7.9	7.7	6.9	7.1	8.3	6.9	6.9	6.9
NH_4^- (mg/l)	0.2	0.2	0.2	0.2	0.2	0.2	0.15	0.15	0.15
NO_2^- (mg/l)	0.1	0.1	0.15	0.001	0.001	0.001	0.001	0.001	0.001
NO_3^- (mg/l)	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
Cl^- (mg/l)	8.2	8.0	8.1	8.2	8.1	8.1	8	8	8.1
SO_4^{2-} (mg/l)	10	11	12	10	12	11	5.5	6	6
HCO_3^- (mg/l)	40.2	40	40	61.2	61	61	61	61	48.8
Ca^{2+} (mg/l)	8.4	8.4	8.4	9.4	9.4	9.4	9.1	8.9	8.8
Mg^{2+} (mg/l)	2.6	2.6	2.6	2.16	2.36	2.36	2.76	2.76	2.76
Na^++K^+ (mg/l)	10.6	10.6	10.6	10.4	10	10.3	10	10	10
$Fe^{2+,3+}$ (mg/l)	0.2	0.2	0.21	0.2	0.2	0.1	0.15	0.1	0.1
TDS (mg/l)	79.8	79.6	81.7	101.4	102.9	102.2	96.4	96.7	84.5
Permanganate-Ox (mg/l)	2.4	2.5	3.2	3.2	3.7	3.8	2.4	2.8	3.0
Bichomatic-Ox (mg/l)	10	12.5	13.4	15	19	21	9.2	12	12.5
BOD	1.1	2.1	2.2	1.2	2.4	1	1	2.1	2.5

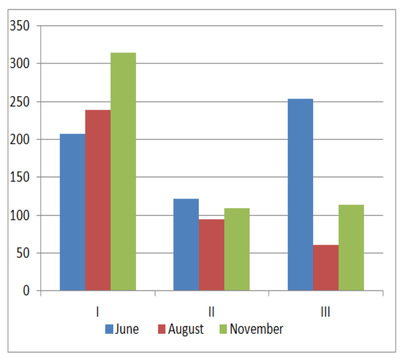
Results

Our results show that macro-invertebrates included in the orders *Ephemeroptera*, *Plecoptera* and *Trichoptera* are most sensitive to the disturbance intensity - their densities sharply decrease with increasing anthropogenic pressure. In natural areas the density of these animals increase from spring to autumn, whereas the density is either decreasing or not vary significantly in disturbed parts of the river. In contrast, the density of the order of *Diptera* is increasing with the anthropogenic influence. We did not find a clear pattern in the variation of density of other invertebrate animal groups (such as *Hemiptera*, *Hirudiena*, *Mollusca*, etc.).

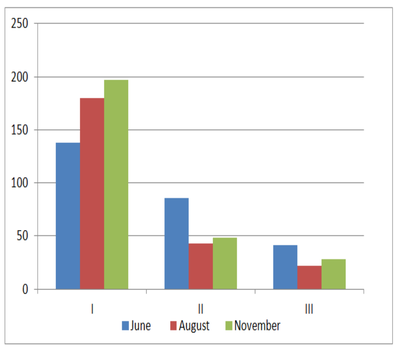
The composition of benthic communities confirmed variation with pollution intensity – the occurrence and abundance of species known in Europe to be sensitive decreased with increasing pollution, while tolerant species increased.

The 2012 ichthyologic inventory showed a very low abundance of fish species (Trout, Batumi shemaya, Pike, Caucasian gudgeon and Colchic nase) known to have been the most abundant species in the Natanebi River in the past. Some fish species are already extinct from the river or are very scarce (Black sea salmon, Trout).

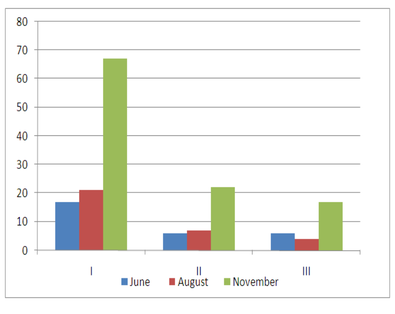
Analyses of water samples show that mineralization varies between 79-103 mg/l and mainly depends on Ca^{2+} and HCO_3^- ions. Permanganate and bichromatic oxidation also show differences between by sites.



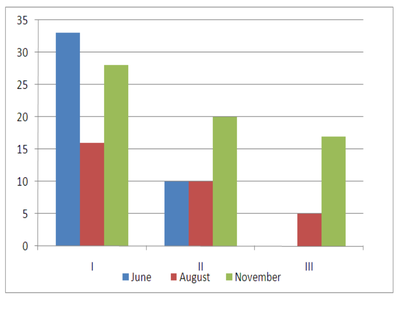
Total density of macro-invertebrate animals in each sampling points



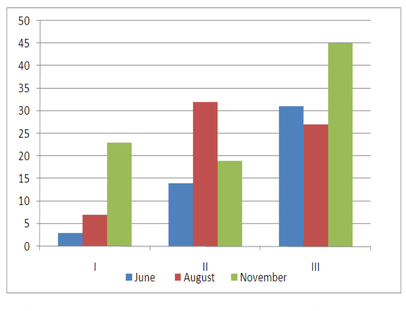
Density of species of the order Ephemeroptera in each sampling points



Density of species of the order Trichoptera animals in each sampling points



Density of species of the order Plecoptera animals in each sampling points



Density of species of the order Diptera in each sampling points

Conclusions

Observations show that migrant fish species are in low abundance because of river dams, hampering fish to migrate to the upstream spawning areas. Other reasons include gravel digging as well as overcatching & poaching, which is quite common still. Collected data will add to the adaptation of European species-environment relationship descriptions to South Caucasus conditions, including a revision of pollution interpretation keys. Improved understanding of these relationships is supporting the assessment of "ecological state" in water bodies, in line with the principles of the WFD currently introduced in Georgia. There is a necessity to continue and collect more samples of the fish and benthos, to study other chemical parameters and physico-morphological features of the riverbed to provide a realistic picture how the pollution and disturbance impact on the living forms in the Natanebri River.