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8. The preliminary observations of anthropogenic effects on the benthic macroinvertebrate communities in the brooks of the Eastern Black Sea region of Turkey: Çağlayan and Ikizdere

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ABSTRACT. The aim of the present research is to determine the different anthropogenic effects on the benthic macroinvertebrates communities with some physico-chemical parameters in the two brooks (Çağlayan and İkizdere) of the East Black Sea Region of Turkey. The study period is about one year and samples are collected seasonally from the upstreams to the down streams of the Brooks at least from the five stations of each. Macroinvertebrate samples are collected with a Surber sampler, sampling area of 0.09 m^2. Water temperature, dissolved oxygen, electrical conductivity and pH are measured *in situ*. According to the preliminary observations; the taxonomic list of benthic macroinvertebrate communities consist of the members of Tricoptera, Ephemeroptera, Diptera, Hemiptera, Plecoptera and Amphipoda orders at the two Brooks in the autumn and winter samplings. Their abundances are changed from the upstreams to the downstreams by the degree of the anthropogenic effects such as fish farms effluents, touristic areas, hydroelectric power stations, the stone breaker plants and the sewages. In the poster, the preliminary results of the benthic macroinvertebrate communities and some physico-chemical parameters in the two Brooks located in the same region under different pollution effects will be presented just for autumn and winter seasons in comparison.

Key words: Benthic macroinvertebrates, water quality, Çağlayan brook, İkizdere brook, Turkey

INTRODUCTION

Due to anthropogenic activities such as urban, industrial and agricultural activities as well as natural events, including precipitation, erosion and climate change, potential use of water decreases day by day. Whereas the lack of treatment plants, the water resources are heavily influenced by the pollution ([***2***]; [***12***]). The pollutants are carried to the lakes, dam lakes and the seas by the running waters which are the most affected areas of the water resources [***16***]. Therefore, damages of the internal water resources are one of the last century's most important environmental problem. In the presence of pollution, characteristic and well-documented changes are induced in the flora and fauna of running waters ([***6***]; [***7***]; [***8***]; [***10***]).

Biological methods have an important role to play in the integrated management of water resources and several advantages over physicochemical methods. In this respect, benthic macroinvertebrates are ideal indicator organisms and there is a clear preference for using them as various taxa are associated with different levels of water quality ([***3***]; [***7***]; [***11***]).

In the Eastern Black Sea of the Turkey, there are 23 running waters, 16 of them flow into the Black Sea and their lengths are ranging between 31.5 - 78.4 km. Although these brooks are the native areas of *Salmo trutta labrax*, they contain untreated domestic and industrial waste ([***5***]; [***15***]; [***17***]).

This study aims to show the preliminary results of the anthropogenıc effects on benthic macroinvertebrate communities and some physico-chemical parameters in the two brooks, Çağlayan and İkizdere, at the Eastern Black Sea Region.

MATERIALS AND METHODS

Study area. İkizdere and Çağlayan brooks are located in the Eastern Black Sea Region of Turkey and flowing to the Black Sea. Their lenghts are 78,4 km, respectively 35 km (**Fig. 1** and **Fig. 2**).

Çağlayan Brook has a good, clear and clean flow of water at most times. Compared with other rivers in the region there is little agricultural development in the Çağlayan catchment. Consequently, there is little sign of erosion, and the river is less prone to increases in turbidity than most others. There are also no significant side branches ([***5***]; [***15***]; [***17***]; [***18***]).

İkizdere Brook has two branches: the main one and an eastern tributary called the Kalkandere. The latter seasonally suffers low flows, and seatrout are not thought to enter it. The main branch is frequently very muddy. There are a stone breaker plant and a power station at the town of Ikizdere, which is supplied with water diverted from higher upstream through tunnels. Consequently, between the power station and the entrance to the tunnel flows are often very low (and the water even more muddy than downstream). Currently there is much erosion and slippage of land in the catchment, contributing to poor water quality ([***5***]; [***15***]; [***17***]; [***18***]).

Sampling. Water and benthic macroinvertebrate samples were collected in November 2013 and February 2014 from five stations in the Çağlayan and six stations in the İkizdere Brook. Benthic macroinvertebrates were collected in triplicate using a Surber sampler with a 0.250 mm mesh size and a sampling area of 0.09 m^2 (30 cm x 30 cm) [***14***].

Biological parameters. Macroinvertebrate samples were stored in plastic bags and transported to the laboratory for processing and identification. The collected material was washed through a series of sieves ranging from 250 to 3000 µm mesh and preserved with a 4% formalin solution. The organisms were identified to the lowest taxonomic level ([***4***]; [***9***]; [***13***]).

Physico-chemical parameters. Water temperature, dissolved oxygen, electrical conductivity and pH were measured *in situ*.

Fig. 1. The Eastern Black Sea Region of the Turkey

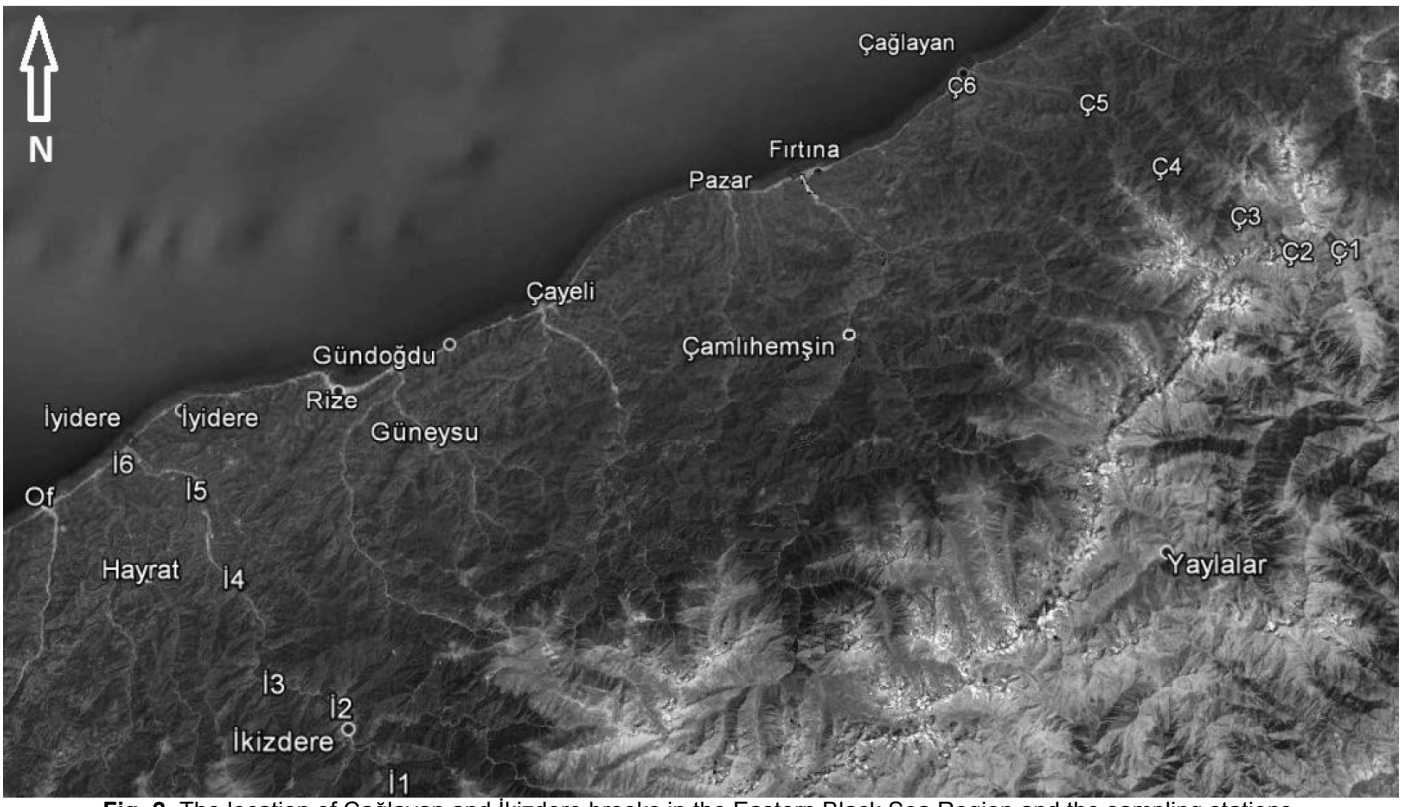

Fig. 2. The location of Çağlayan and İkizdere brooks in the Eastern Black Sea Region and the sampling stations.

RESULTS AND DISCUSSION

During preliminary observations of the study in the autumn and winter seasons, water temperature values in all stations ranged between 6.20 - 13.20^{o}C in the Çağlayan Brook, and between 2.4 - 12.30 ^{o}C in the İkizdere Brook; dissolved oxygen and pH values ranged between 10.08 - 12.14 mg L^{-1} and 6.8 - 7.9 in the Çağlayan Brook, respectively between 10.19 - 12.76 mg L^{-1} and 7.2 - 8.1 in the İkizdere Brook, electrical conductivity values range between 27.9 - 41.7 mS cm^{-1} in the Çağlayan Brook, respectively between 35.7 - 102.4 mS cm^{-1} in the İkizdere Brook.

Among the brooks, the most affected one from the human activities was İkizdere Brook, electrical conductivity values showed the loading in İkizdere, so it is thought that trout didn't prefer to enter. Human activies were very slight and electrical conductivity values were lowest in Çağlayan Brook. The water temperature values were higher in the Çağlayan Brook than in the İkizdere Brook, however dissolved oygen and pH values were similiar in the two brooks.

The taxonomic list of benthic macroinvertebrate community consist of Tricoptera, Ephemeroptera, Diptera, Hemiptera, Plecoptera and Amphipoda orders at the two brooks in the autumn and winter (**Table 1**).

Distributions and abundances of benthic macroinvertebrates in the Çağlayan and İkizdere Brooks was given in **Table 2**.

Table 1

The taxonomic list of benthic macroinvertebrates in the Çağlayan and İkizdere brooks

Tricoptera
Lepidostomatidae- *Lepidostoma* sp
Sericostomatidae- *Sericostoma* sp
Phyacophilidae- *Rhyacophila* sp
Ephemeroptera
Baetidae- *Beatis* sp
Leptophlebiidae- *Haprophlebia* sp
Diptera
Tipulidae- *Tipula* sp
Tabanidae- *Tabanus* sp
Chironomidae- *Chironomus* sp
Hemiptera
Gerridae
Plecoptera
Perlidae
Amphipoda
Gammaridae

Table 2

Distributions and abundances of benthic macroinvertebrates in the two brooks (Çağlayan and İkizdere)

		AUTUMN						**WINTER**					
	Stations	**1**	**2**	**3**	**4**	**5**	**6**	**1**	**2**	**3**	**4**	**5**	**6**
ÇAĞLAYAN	***Trichoptera***												
	Sericostomatidae	1		1				2	1	1	6		
	Diptera												
	Tipulidae			2					2	3	20	4	
	Tabanidae		1	1	3	3			1	1	3		
	Plecoptera												
	Perlidae									1			
İKİZDERE	***Trichoptera***												
	Sericostomatidae	14	4		1			8	6	2	3	1	1
	Lepidostomatidae	3		2									
	Phyacophilidae					2							
	Diptera												
	Tipulidae	2	4	2	2		1	1		1	5	2	
	Chironomidae								4		3	1	44
	Ephemeroptera												
	Beatidae	1											
	Leptophlebiidae											1	
	Hemiptera												
	Gerridae	*3*											
	Plecoptera												
	Perlidae			1									
	Amphipoda												
	Gammaridae									1			

On Çağlayan Brook there is a small scale land based trout farm (3 tonnes capacity/year). Compared with the other rivers in the region there is little agricultural development in the Çağlayan catchment. The mostly affected one from the human activities is İkizdere Brook. There is a town located at the edge of the brook and there are at least 20 hydroelectrical power stations on the brook. Besides currently there is much erosion and slippage of land in the catchment, contributing to poor water quality. So, seatrout are not thought to enter it and fish farming was ended ([***5***]; [***15***]; [***17***]; [***18***]).

Undisturbed environments are characterized by high diversity or richness of benthic macroinvertebrates. Organic pollution causes a decrease in diversity as sensitive organisms are lost, an increase in the abundance of tolerant organisms. Toxic and acidic pollution may cause a decrease in both diversity and abundance as sensitive organisms are eliminated [***11***]. In our study, according to the preliminary results from the autumn and winter seasons, in Cağlayan Brook there were present species of three order and four families of invertebrates, whereas in İkizdere Brook there were present species of six orders and eleven families. Consequently, the taxa richness was higher in the İkizdere Brook. The benthic macroinvertebrate communities consisted of Trichoptera, Diptera (Tipulidae, Tabanidae) and Plecoptera (Perlidae) orders in the Çağlayan Brook. Sercostomatidae (Trichoptera) is a sensitive family and they are organisms of cool, highly oxygenated, clean head water streams - it was identified in the first stations of the two brooks, and their abundances were highest. From Diptera, the families Tibulidae intolerant or moderately intolerant to nutrient pollution, making them fairly good water quality indicators and was found in the two brooks, while Tabanidae (moderately tolerant to nutrient pollution) was observed in Çağlayan Brook. In addition, Chironomidae, which are the most tolerant ones from Diptera, was identified in the İkizdere Brook in winter and its abundance is higher at the 6th station. From Ephemeroptera *Baetis* sp., *Haprophlebia* sp. and *Ecdyonorous* sp. intolerate the water that is not fast flowing and their presence in a waterbody indication of a relatively pristine habitat were found in the İkizdere Brook at the first station in a few abundance. The other organisms found in the İkizdere Brook were moderately tolerant to nutrient pollution ([***10***]; [***11***]).

CONCLUSIONS

The preliminary observations exhibited the benthic macroinvertebrate communities at the three Brooks; Cağlayan Brook was at least disturbed one and the families of the benthic macroinvertebrates sustained this status. The presence of moderatly tolerance organisms of benthic macroinvertebrates showed that İkizdere Brook is under pollution treat [***1***], although their abundances were low. After the further samplings, the succession of the benthic macroinvertebrate communities will lead us a concrite conclusion, additionally the applications of various biotic and diversity indices to the results of the study will also show us the final state of the brooks in question.

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