

Water Quality Monitoring of Meriç, Tunca and Ergene Rivers (Edirne, Turkey) in Rainy Season

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Abstract

Meriç River is a significant river ecosystem for the Thrace Region and Balkans and Tunca and Ergene Rivers are the chief tributaries of Meriç River. In the present investigation, surface water qualities of Meriç, Tunca and Ergene Rivers were monitored and the pressure of agricultural applications on the system was assessed. Surface water samples were taken during the spring season of 2019 from 3 stations (upstream of Meriç River and downstream of Tunca and Ergene Rivers) and some water quality parameters (pH, oxygen saturation, EC, dissolved oxygen, TDS, turbidity, nitrate, phosphate, nitrite, salinity, sulphate, COD and BOD) were measured. As a result of detected physical and chemical data, nitrogen and phosphorous compound concentrations in water of Meriç, Tunca and Ergene Rivers were found as in quite high levels and contamination levels were recorded as; Ergene River > Tunca River > Meriç River in general.

Keywords: Meriç River, Tunca River, Ergene River, Water quality, Monitoring

INTRODUCTION

Streams and rivers are among the most significant affected water bodies from pollution. Therefore, it is required to evaluate numbers of limnologic parameters for an effective control and a useful management [1 – 4]. Meriç River, which has a length of about 480 km and a catchment area of about 56,000 km², is one the most significant lotic habitat of Balkans. Tunca and Ergene Rivers are the most important tributaries of Meriç River and they are known to be exposed to an intensive organic and inorganic pollution [5 – 10]. The aim of the present research was to determine and monitor the water quality of Meriç, Tunca and Ergene Rivers and to evaluate the pressure of agricultural applications on the system.

MATERIAL AND METHOD

Sample Collection

Surface water samples were taken during the spring season of 2019 for 3 times (first, second and third weeks of April) from 3 stations selected on the Meriç, Tunca and Ergene Rivers before they mixing. Some explanations and the localities of selected stations are given in Table 1 and map of study area is given in Figure 1.

Table 1. Coordinates of selected stations

Station Number	Locality	Coordinates		Explanation
		North	South	
S1	Edirne	41.66244	26.55151	Meriç River (Middlestream)
S2	Edirne	41.66850	26.55413	Tunca River (Downstream)
S3	Uzunköprü	41.28291	26.69906	Ergene River (Downstream)

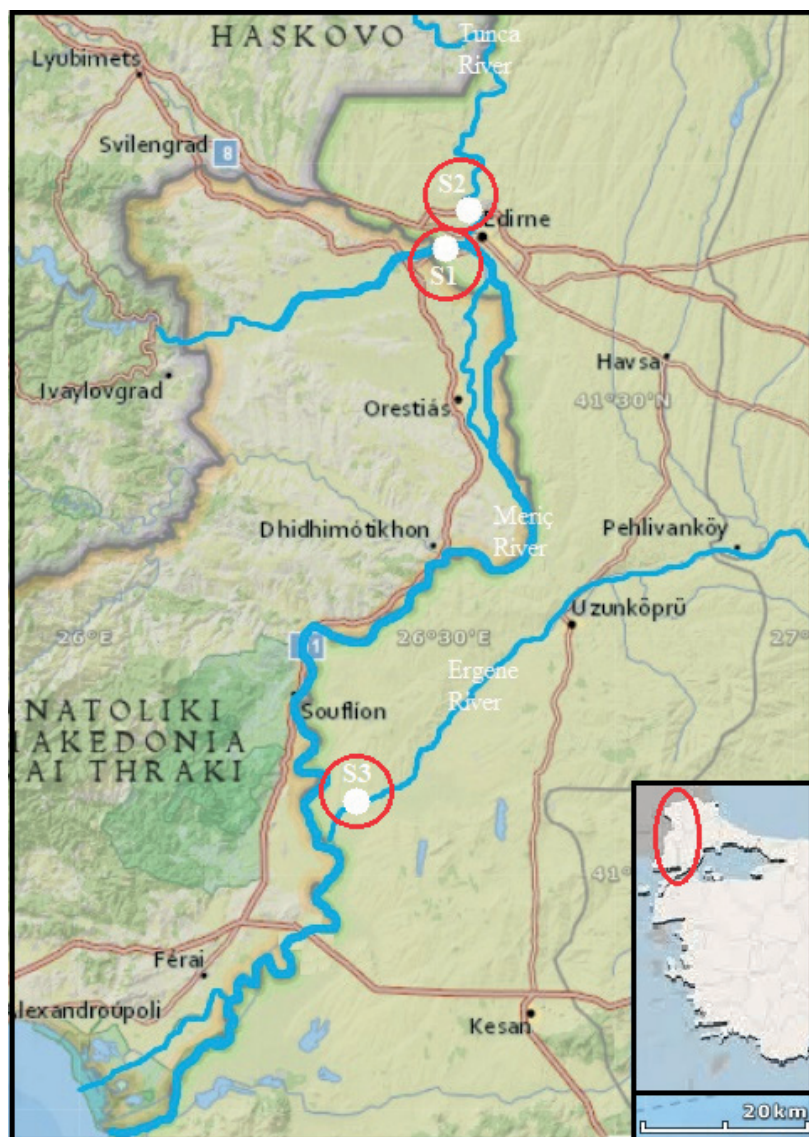


Figure 1. Map of the study area

Physicochemical Analysis

Dissolved oxygen (DO), oxygen saturation (OS), pH, electrical conductivity (EC), total dissolved solids (TDS) and salinity parameters were determined by using “Hach Lange HQ40D Multiparameter” device during the field studies; turbidity parameter was determined by using “Hach Lange 2100Q Portable Turbiditymeter” device during the field studies; nitrate (NO_3), nitrite (NO_2), phosphate (PO_4), sulphate (SO_4) and chemical oxygen demand (COD) parameters were determined by using “Hach Lange DR3900 Spectrophotometer” device during the laboratory studies; biological oxygen demand (BOD) parameter was determined by using “Hach Lange BOD Trak II” device during the laboratory studies.

RESULTS AND DISCUSSION

Results of detected physicochemical parameters on Meriç, Tunca and Ergene Rivers and surface water quality standards according to Turkish Regulations are given in Table 2 and the graphics of detected data are given in Figure 2.

According to the Turkish Regulations, Meriç, Tunca and Ergene Rivers have Class I water quality in terms of pH and

nitrate parameters; Meriç and Tunca Rivers have Class I and Ergene River has Class II water quality in terms of TDS parameter; Meriç and Tunca Rivers have Class I and Ergene River has Class III water quality in terms of dissolved oxygen, oxygen saturation, BOD and COD parameters; Meriç and Tunca Rivers have Class II and Ergene River has Class III water quality in terms of nitrite parameter; Meriç River has Class I, Tunca River has Class II and Ergene River has Class III water quality in terms of EC parameter; and Meriç River has Class II, Tunca River has Class III and Ergene River has Class IV water quality in terms of phosphate parameter in general [11 – 13].

Nitrite can reach quite high levels, especially in organically contaminated waters, where oxygen is not sufficient [14]. According to the EC directive reported by the European Commission, the concentration of nitrite in water for the health of Cyprinid is not expected to exceed the 0.03 mg / L limit [15]. Accordingly, the nitrite concentrations detected in the Tunca and Ergene Rivers pose a significant risk for Cyprinid health. As it is known, the most important sources of nitrite in water; organic substances, nitrogenous fertilizers and some minerals [16, 17].

Phosphorus in ground and surface waters depends on population density, agricultural fertilization methods and fertilization frequency. Vegetation and soil structure also have a significant effect on phosphorus accumulation

in water. In addition, it is reported that the detergents used in cleaning works and reaching the receiving water environment with waste water are the significant factors that affect the phosphorus concentration in water [11].

Quite high nitrite and phosphate values determined in

the watershed waters may indicate that the wastes of the settlements are being discharged into the system without treatment and the agricultural fertilizers used in the watershed may be an ecologically important stress source.

Table 2. Physicochemical parameters recorded in the basin and some limits

Limit Values and the Results DO (mg/L) OS (%)		Parameters													
		pH	EC (mS/ cm)	*TDS (mg/L)	Salinity (‰)	Turbidity (NTU)	NO ₃ (mg/L)	NO ₂ (mg/L)	**PO ₄ (mg/L)	*SO ₄ (mg/L)	BOD (mg/L)	COD (mg/L)			
Water Quality Classes I. Class II. Class III. Class IV. Class	I. Class	8	90	6.5-8.5	400	500	-	-	5	0.01	0.02	200	4	25	
	6	70	6.5-8.5	1000	1500	-	-	10	0.06	0.16	200	8	50		
	3	40	6.0-9.0	3000	5000	-	-	20	0.12	0.65	400	20	70		
	<3	<40	Out of 6.0-9.0	>3000	>5000	-	-	>20	>0.3	>0.65	>400	>20	>70		
Present Study	1. week	S1 (Meriç)	9.27	95.0	8.37	263	152	0.15	4.11	1.6	0.011	0.180	49.0	1.3	5.9
		S2 (Tunca)	9.07	92.4	8.39	615	365	0.36	6.88	1.0	0.032	0.300	80<	1.5	12.0
		S3 (Ergene)	3.47	36.4	7.87	1831	1068	1.08	18.70	0.7	0.105	0.650	80<	13.0	66.3
	2. week	S1 (Meriç)	8.35	89.7	8.30	353	196	0.19	8.05	2.0	0.020	0.150	65.0	1.5	12.0
		S2 (Tunca)	8.16	89.6	8.29	707	389	0.39	7.97	2.6	0.051	0.290	80<	3.4	21.2
		S3 (Ergene)	5.19	55.8	7.42	1226	697	0.70	112.00	0.9	0.101	0.340	80<	7.9	30.8
	3. week	S1 (Meriç)	8.39	95.9	7.99	367	188	0.19	6.34	2.1	0.020	0.150	57.0	2.3	8.9
		S2 (Tunca)	8.09	92.4	8.06	715	372	0.37	9.12	0.8	0.040	0.230	80<	2.5	10.4
		S3 (Ergene)	5.05	57.4	8.13	1879	1009	1.02	13.70	1.1	0.112	0.790	80<	17.0	62.7

*: According to Turkish Regulations [12]; **: According to Uslu and Türkman [11]

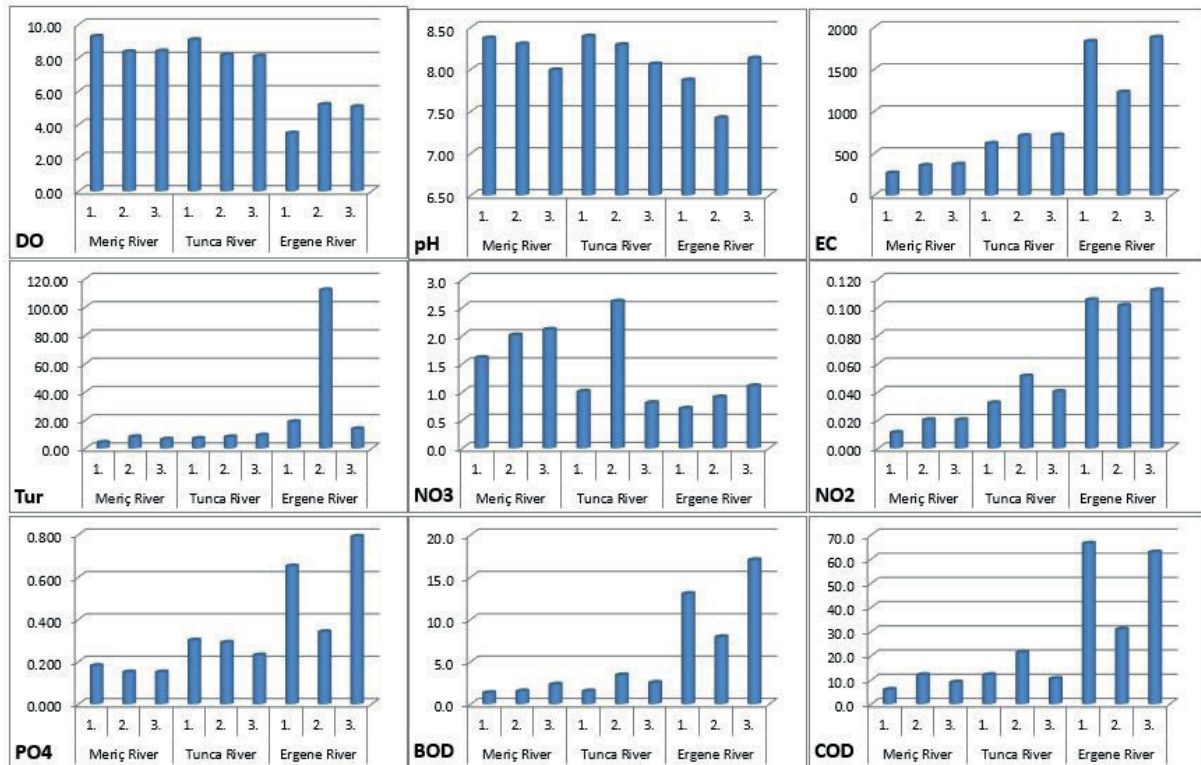


Figure 2. Diagrams of physicochemical parameters

COCNCLUSIONS

In the present investigation, water qualities of Meriç, Tunca and Ergene Rivers were monitored in rainy season by investigating some limnologic pollution parameters. According to data observed, the adverse effects of Tunca and Ergene Rivers on the basin was clearly determined and the contamination levels of the investigated river ecosystems were recorded as; Ergene River > Tunca River > Meriç River in general. As a result of this research, nitrite and phosphate were found as the riskiest parameters for the basin and the accumulations of these parameters in water of the system components were detected in quite high levels and exceed the critical limit values. The detected data clearly reveals that agricultural runoff caused from intensive fertilizer applications and municipal sewage water caused from settlement areas are the main contamination sources for the Meriç River Basin.

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