

**GIS BASED WATER QUALITY ASSESSMENT OF
ANADERE STREAM BASIN A SIGNIFICANT SUB-BASIN
OF ERGENE RIVER IN THRACE REGION (TÜRKIYE)**

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Cem Tokatli

Trakya University, Evrenos Gazi Campus, Edirne, Türkiye

ABSTRACT

Water pollution has become a global concern in especially recent years and contamination of freshwater habitats is top of attention for all over the world. Anadere Stream Basin, which is known as being adversely affected from agricultural and domestic discharges, is one of the most significant sub – basin of Ergene River that is the most significant watershed in Thrace Region of Türkiye. The aim of this research was to investigate the water quality of Anadere Stream Basin by measuring a total of 10 significant water quality assessment parameters including dissolved oxygen (DO), oxygen saturation (%O₂), pH, electrical conductivity (EC), total dissolved solids (TDS), salinity, turbidity, nitrate (NO₃), nitrite (NO₂) and phosphate (PO₄) and to assess the water quality by using Geographic Information System (GIS). For this purpose, surface water samples were collected from 12 selected stations (from upstream to downstream; A1 – A12) located on the Anadere Stream Basin in winter season (December) of 2019. As a result of this study, the mean recorded values of investigated water quality parameters in Anadere Stream Basin were found as: 11.37 mg/L for DO, 107.83% for %O₂, 8.48 for pH, 729.15 µS/cm for EC, 447.50 mg/L for TDS, 0.45 ‰ for salinity, 27.30 NTU for turbidity, 1.81 mg/L for NO₃, 0.03 mg/L for NO₂ and 0.30 mg/L PO₄.

Keywords: Anadere Stream Basin, Water quality, Geographic Information System

INTRODUCTION

Especially due to the increasing population, unconscious consumption of natural resources and insufficient environmental awareness in humans, environmental pollution has become one of the most important problems in the world in recent years [1 – 3]. Freshwater pollution by especially organic pollutants because of agricultural and domestic discharges are among the most important environmental issues all around the world [4 – 7].

Thrace Region is located on the northwest part of Türkiye. Although the region covers about 3% part of country, approximately 15% of the total population lives in this region [8 – 10]. Ergene River Basin, which is one of the main parts of the Meriç River Basin, is one of the most important watersheds located in the Thrace Region of Türkiye. Anadere Stream Basin, which is located in the north-west part of Türkiye, is one of the most important sub–basin of Ergene River and it is being adversely affected by agricultural and domestic wastewater discharges [11 – 13].

The main objectives of this investigation were (1) to assess the water quality of Anadere Stream Basin by determining a total of 10 important limnological parameters (dissolved oxygen, oxygen saturation, pH, electrical conductivity, total dissolved solids, salinity,

turbidity, nitrate, nitrite and phosphate) and (2) to evaluate the water quality by using Geographic Information System (GIS).

MATERIALS AND METHODS

Sample collection

In the present research, freshwater samples were collected from 12 locations selected on the Anadere Stream Basin in rainy (winter) season of 2019. The coordinate information of the selected stations is given in Table 1 and the topographic map of study area with the selected sampling points are given in Figure 1.

Psychochemical Analysis

Dissolved oxygen (DO), oxygen saturation (%O₂), pH, electrical conductivity (EC), total dissolved solids (TDS) and salinity variables were determined by using a multi – parameter device (Hach Lange – HQ40D) in the field studies; turbidity variable was determined by using a portable turbidimeter device (Hach Lange – 2100Q) in the field studies; nitrate (NO₃), nitrite (NO₂) and phosphate (PO₄) variables were determined by using a colorimeter device (Hach Lange – DR890) in the laboratory studies.

Table 1. Coordinate information of the sampling points

Station Code	Name of Habitat	GPS – North	GPS – East	Station Code	Name of Habitat	GPS – North	GPS – East
A1	Bağlar Stream	41.814	26.845	A7	Söğütlü Stream	41.639	26.802
A2	Keldere Stream	41.802	26.877	A8	Büyükçobanlı Stream	41.641	26.825
A3	Reselli Stream	41.730	26.846	A9	Köydere Stream	41.572	26.747
A4	Toy Stream	41.725	26.819	A10	Olukbaşı Stream	41.559	26.782
A5	Somurcalı Stream	41.721	26.796	A11	Anadere Stream	41.421	26.821
A6	Akardere Stream	41.636	26.755	A12	Anadere Stream	41.347	26.885

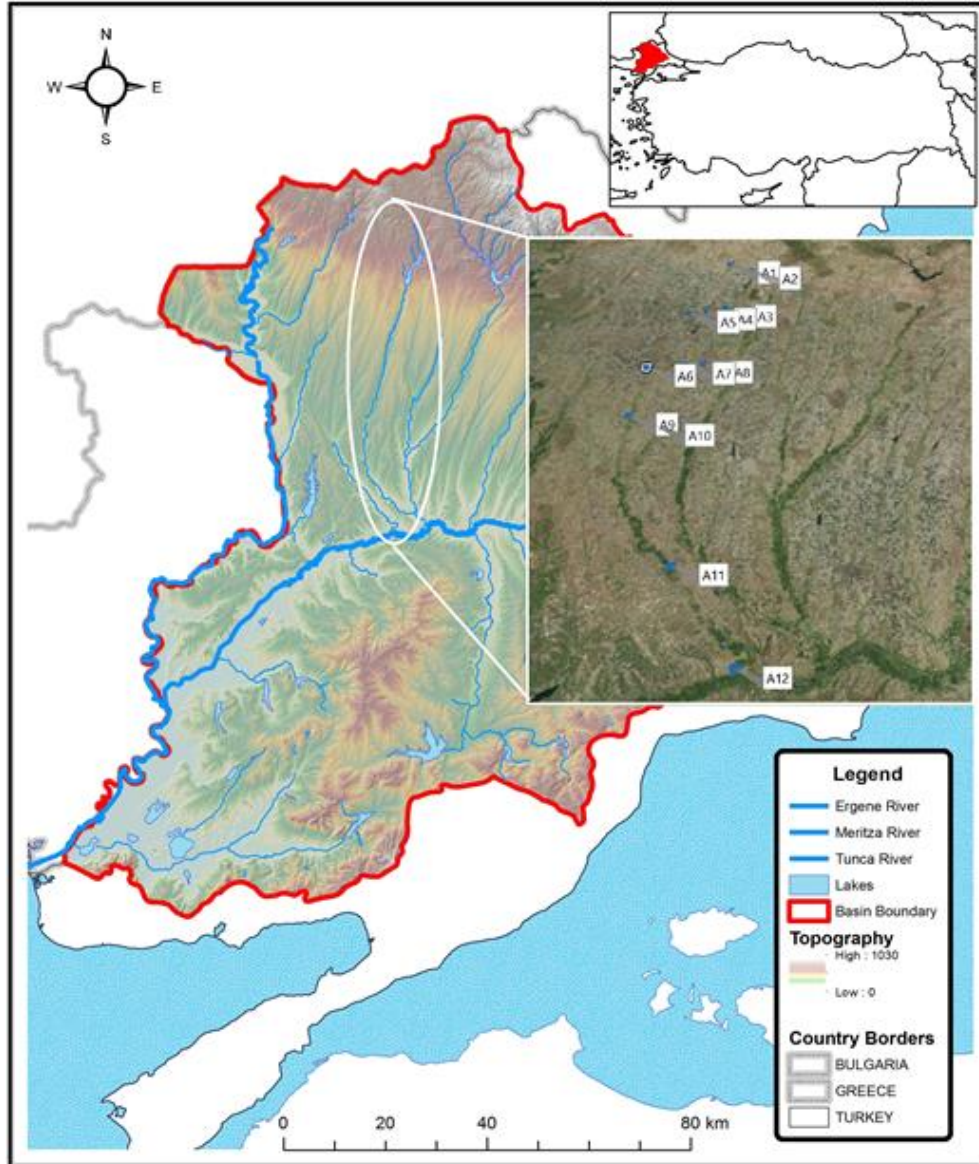


Figure 1. Ergene River Basin and selected stations on the Anadere Stream Basin

RESULTS AND DISCUSSION

The results of measuring 10 water quality parameters in Bağlar, Keldere, Reselli, Toy, Somurcalı, Akardere, Söğütlü, Büyükçobanlı, Köydere, Olukbaşı, Anadere Streams are given in Figure 2 and the GIS based distribution maps of selected 6 significant water quality parameters in the basin are given in Figure 3.

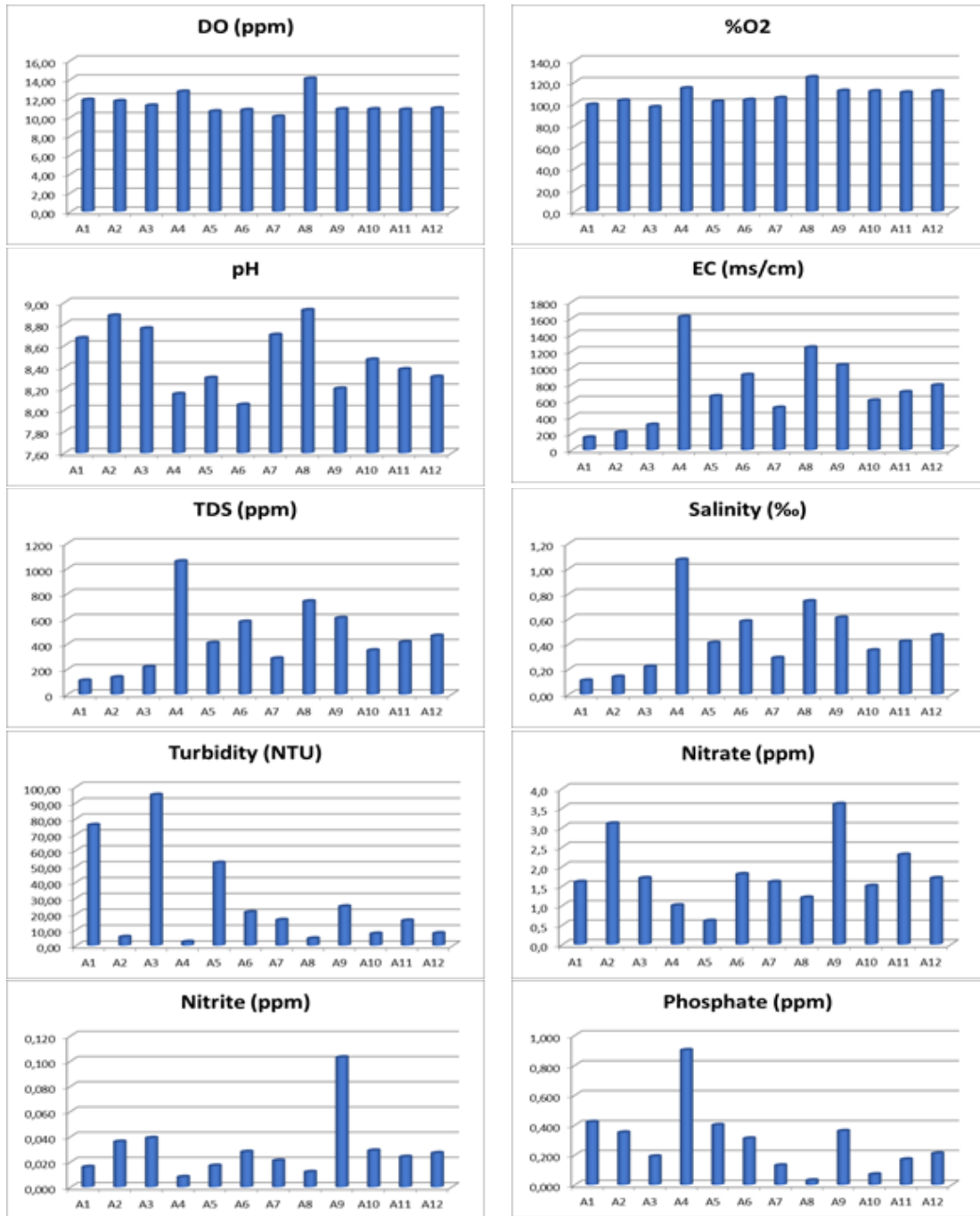


Figure 2. Results of investigated parameters

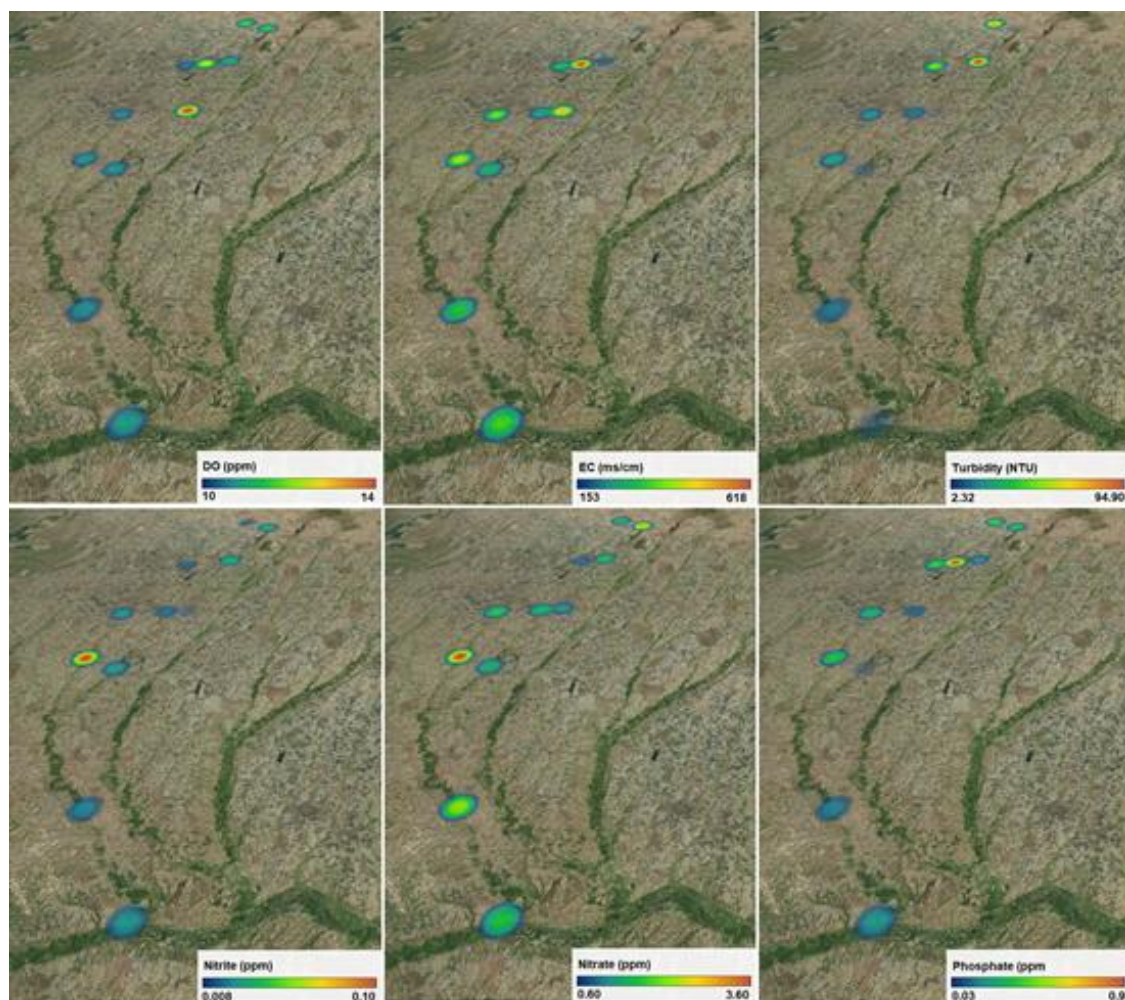


Figure 3. GIS based distribution maps of parameters

Significant spatial differences were not detected in dissolved oxygen, oxygen saturation, pH and nitrate values and the mean values of these parameters in the water of Anadere Stream were 11.37 mg/L, 107.83%, 8.48 and 1.81 mg/L respectively.

Nevertheless, significant spatial differences were detected between EC, TDS, salinity, nitrite and phosphate values. While the highest EC, TDS and salinity values were detected at the A4 (Toydere Stream) station (1618 $\mu\text{S}/\text{cm}$, 1057 mg/L and 1.07 ‰ respectively), the lowest EC, TDS and salinity values were determined at the A1 (Bağlar Stream) station (154 $\mu\text{S}/\text{cm}$, 110 mg/L and 0.11 ‰ respectively). The minimum and maximum levels of nitrite and phosphate parameters in the basin waters were recorded as 0.008 mg/L – 0.103 mg/L for nitrite and 0.030 mg/L – 0.901 mg/L for phosphate.

Anadere Stream Basin has 1st class (> 8 mg/L) water quality in terms of DO parameter; it has 2nd class (400 – 1000 $\mu\text{S}/\text{cm}$) water quality in terms of EC parameter; it has 1st class (< 3 mg/L) water quality in terms of NO_3 parameter; and it has 3rd class (> 0.16 mg/L) water quality in terms phosphate parameter [14].

It has been determined that the organic pollutant contents of the Anadere Stream Basin waters, especially the phosphate contents, were recorded as at slightly high levels. Agricultural applications may significantly raise the concentrations of nitrogen and phosphorus compounds in soil and water and it is clearly known that one of the main anthropogenic resources of phosphate is domestic wastewater [15 – 18].

To evaluate the contamination status of the investigated parameters in waters of the Anadere Stream Basin, the levels of water quality parameters obtained from the current research were compared with those reported by previous investigations in Türkiye (Table 2).

The average levels of dissolved oxygen and pH values detected in the waters of Anadere Stream Basin in the current research were higher than detected in Meriç and Ergene Rivers and Emet, Porsuk and Sazlıdere Streams. Nitrite and phosphate values recorded in the current research were found to be lower than the other compared lotic ecosystems except the Meriç River, while the EC and salinity variables were higher than the other compared aquatic habitats except the Ergene River and Sazlıdere Stream [19 – 22].

Table 2. Comparison of parameters in current study with other fluvial habitats

	DO mg/L	pH	EC μS/cm	Sal ‰	Tur NTU	NO ₃ mg/L	NO ₂ mg/L	PO ₄ mg/L	Reference
Anadere Stream	11.37	8.48	729	0.45	27.30	1.81	0.03	0.30	Current Research
Meriç River	8.67	8.22	327	0.18	6.17	1.90	0.02	0.16	[19]
Ergene River	4.57	7.81	1645	0.93	48.13	0.90	0.11	0.59	[19]
Emet Stream	9.32	7.92	652	0.39	-	1.23	0.03	0.68	[20]
Porsuk Stream	7.71	7.69	618	0.32	-	1.37	0.08	-	[21]
Sazlıdere Stream	9.99	8.34	761	0.49	12.50	2.00	0.04	0.39	[22]

DO: Dissolved oxygen; Sal: Salinity; Tur: Turbidity

CONCLUSIONS

measuring some significant water quality assessment parameters. According to the result of this study, water of Anadere Stream Basin was found as slightly contaminated by organic pollutants. The water of the basin has 1st class water quality in terms of DO and nitrate parameters, while it has 2nd class water quality in terms of EC parameter and has 3rd class water quality in terms phosphate parameter.

In line with the current data, it may be recommended that use of unconscious fertilizers must be avoided in the region and discharges of municipal sewage without any treatment must be prevented in order to improve the quality and provide the sustainability of aquatic life in the Anadere Stream Basin.

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