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Chemical Oxygen Demand Levels in Streams of Çanakkale Strait Basin (Türkiye)

Cem Tokatlı[1*], Memet Varol[2]

[1]Trakya University, Edirne / Türkiye
[2]Malatya Turgut Özal University, Malatya / Türkiye

Abstract

In this study, the spatial distributions of Chemical Oxygen Demand (COD) levels a significant pollution indicator in water of lotic ecosystems in the Çanakkale Strait (ÇS) watershed were determined. 7 fluvial habitats flowing into the ÇS (total of 20 stations from up-streams to down-streams) were defined in the basin. Surface water samples were collected in the spring season of 2023. Then they were tested for the COD parameter. The determined spatial mean values of COD levels in water of the investigated riverine habitats in ÇS watershed were 8.62 mg/L for Munipbey Stream, 4.93 mg/L for Bağlar Stream, 41.60 mg/L for Kayaaltı Stream, 19.83 mg/L for Umurbey Stream, 17.35 mg/L for Çanakkale Stream, 15.70 mg/L for Hamamlık Stream and 9.96 mg/L Küçük Menderes Stream. It has been determined that the COD levels of the investigated rivers increase from the up-stream to the down-stream stations and Kayaaltı, Umurbey and Çanakkale streams were recorded as the riskiest component for the ÇS watershed.

Keywords: *Çanakkale Strait, Chemical Oxygen Demand, Water quality*

Introduction

Increasing pollution in freshwater ecosystems is one of the most critical global problems of recent years. Although both natural and anthropogenic processes are effective in environmental pollution, human induced factors are known as the main contaminants for all the components of biosphere (Köse et al., 2020; İslam et al., 2022; Ustaoğlu et al., 2022; Jannat et al., 2022; Mia et al., 2023; Haq et al., 2023; Yüksel et al., 2024; Muhammad et al., 2024).

Chemical Oxygen Demand (COD) is a critical parameter in water quality assessment. It measures the amount of dissolved oxygen needed to chemically oxidize organic and inorganic materials in water. High COD levels suggest a high concentration of organic pollutants, which can deplete dissolved oxygen in water bodies, negatively impacting aquatic life and water quality. COD is used to gauge the short-term impact of wastewater effluents on the oxygen levels of receiving waters. It is essential for monitoring and managing the organic load in municipal and industrial wastewater treatment (Varol and Tokatlı, 2021; 2023; Tokatlı and Varol, 2021; Haque et al., 2023; Mutlu et al., 2023; Tokatlı et al., 2023).

Çanakkale Strait (ÇS) is located in the Marmara Region. It is known that this important ecosystem faces significant environmental problems caused by domestic wastewater and organic pollutants originating from settlements due to population growth in the Marmara Region (Rozakēs, 1987; Mercan, 2019; Tokatlı et al., 2023; 2024; Varol and Tokatlı, 2024). There are a total of 7 significant riverine ecosystems in the watershed of ÇS. Due to many anthropogenic pressure elements in their large basins, they release their organic pollution contents into the strait water. In this research, COD levels of 7 lotic ecosystems located in the watershed of ÇS were investigated.

Materials and Methods

Total of 20 sampling stations (ÇS1 – ÇS20) on 7 riverine habitats located on the ÇS watershed were selected. The maps of the Çanakkale Strait Basin and selected stations are given in Figure 1 and the names of investigated fluvial habitats are given in Table 1.

Surface water samples were collected in the spring season of 2023 into the pre-cleaned gamma sterile polyethylene bottles (APHA, 2005).

Chemical Oxygen Demand (COD) levels were measured by a “Hach DR3900” branded spectrophotometer device (APHA, 1999).

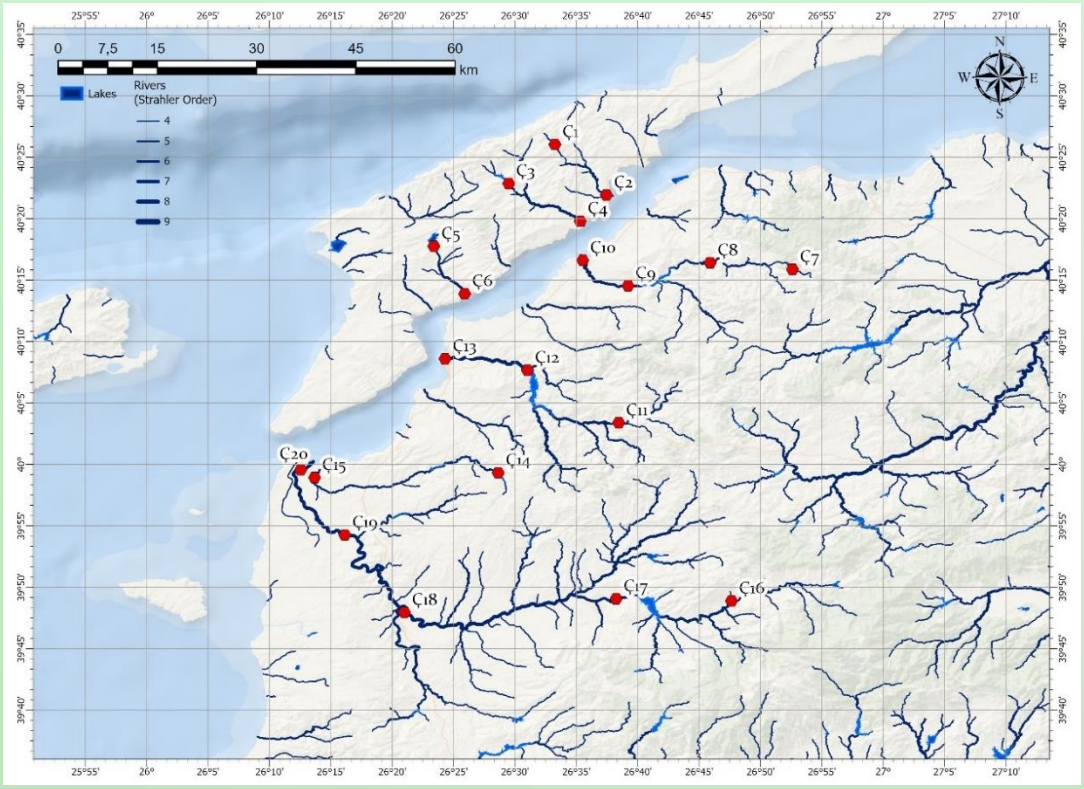

Figure 1. Study area and sampling stations

Table 1. Names of streams and sampling locations

Station Code	Name of Potamic	Sampling Location	Station Code	Name of Potamic	Sampling Location
Ç1	Munipbey Creek	Upstream	**Ç11**	Çanakkale Stream	Upstream
Ç2		Downstream	**Ç12**		Midstream
Ç3	Bağlar Creek	Upstream	**Ç13**		Downstream
Ç4		Downstream	**Ç14**	Hamamlık Creek	Upstream
Ç5	Kayaaltı Creek	Upstream	**Ç15**		Downstream
Ç6		Downstream	**Ç16**	Küçükmenderes Stream	Upstream
Ç7	Umurbey Stream	Upstream	**Ç17**		Up-Midstream
Ç8		Up-Midstream	**Ç18**		Midstream
Ç9		Down-Midstream	**Ç19**		Down-Midstream
Ç10		Downstream	**Ç20**		Downstream

Results and Discussion

The data of measured COD parameter in fluvial habitats of Çanakkale Strait (ÇS) watershed are given in Figure 2. Significant spatial differences were detected among the measured COD levels in water of the ÇS watershed components. According to the results of this research, the recorded spatial mean values of COD parameter in water of the investigated fluvial ecosystems in ÇS watershed were 8.62 mg/L for Munipbey Stream, 4.93 mg/L for Bağlar Stream, 41.60 mg/L for Kayaaltı Stream, 19.83 mg/L for Umurbey Stream, 17.35 mg/L for Çanakkale Stream, 15.70 mg/L for Hamamlık Stream and 9.96 mg/L Küçük Menderes Stream.

Except for the sampling points located in the downstream basins of Kayaaltı (Ç6), Umurbey (Ç10) and Çanakkale (Ç13) streams, the water quality of the entire basin was recorded as 1. Class in terms of COD values (TSWQR, 2021). While the stations of Ç6 and Ç10 have 3. Class water quality in terms of COD values, station of Ç13 has 2. Class water quality (TSWQR, 2021).

The discharge point of domestic wastewater in Çanakkale Province city centre is known as Çanakkale Stream. Despite the advanced wastewater treatment plant operated by Çanakkale Municipality, values of the COD parameters in this location were determined to be at quite high levels (Mercan, 2019; Anonymous, 2021; Tokatlı et al., 2023). Although the downstream basin of the Çanakkale Stream has a lower COD value than the downstream basins of Kayaaltı and Umurbey streams, it has been determined that the pollution pressure over the Çanakkale Strait is much higher since the Çanakkale Stream flow is considerably higher than the other streams.

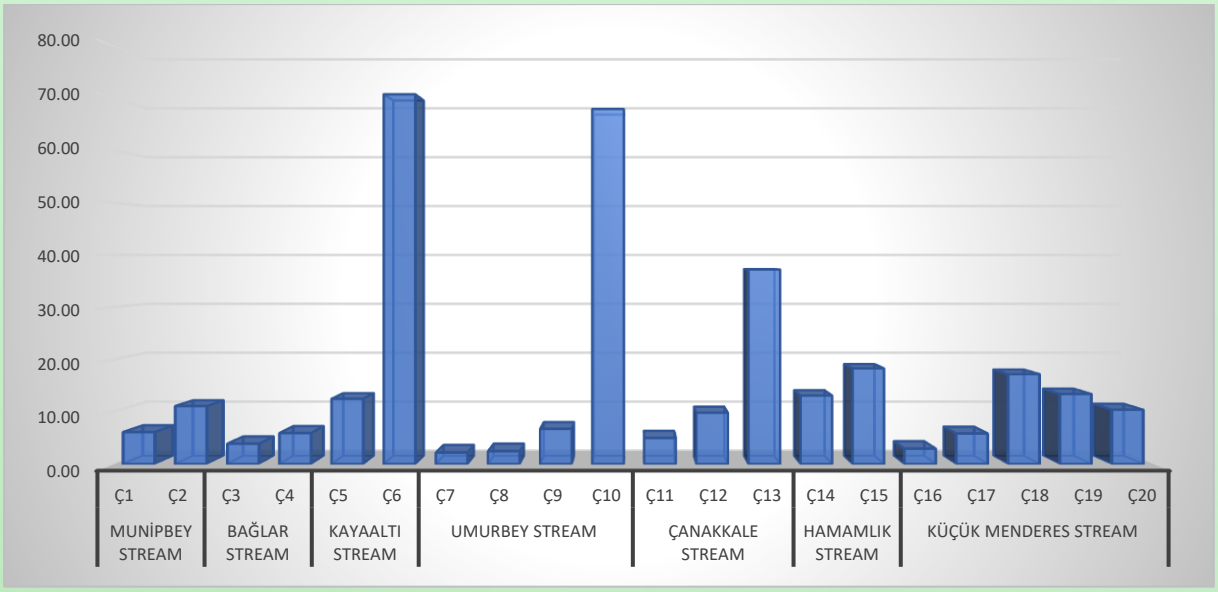

Figure 2. COD levels of investigated stations (mg/L)

Conclusions

In this research, COD levels of fluvial habitats flowing into the Çanakkale Strait (ÇS) were investigated and the pollution pressures of the rivers on this important strait were evaluated. The COD contents of the fluvial water bodies of ÇS basin were as follows: Kayaaltı > Umurbey > Çanakkale > Hamamlık > Küçükmenderes > Munipbey > Bağlar, in general. However, considering the flow rates of the investigated streams, it was determined that the riskiest component for ÇS watershed was the Çanakkale Stream and domestic wastewaters were thought as the most critical pollution pressure factor for the system.

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