Turkish Journal of Water Science & Management
ISSN: 2536 474X / e-ISSN: 2564-7334

Volume: 5 Issue: 1 Year: 2021

Research Article

The Trichoptera Fauna of Ulupınar Stream and Its Relationship with Water Quality

Ulupınar Çayı'nın Trichoptera Faunası ve Su Kalitesi ile İlişkisi

Aynur Kayan*
Department of Biology, Faculty of Science and Letters, Süleyman Demirel University, Isparta, Turkey
ozenaynur7@gmail.com (https://orcid.org/0000-0002-9653-5506)
Received Date: 30.10.2020, Accepted Date: 08.12.2020

Abstract

In this study it was aimed to determine the Trichoptera fauna and water quality of Ulupınar Stream which is an important tourism destination of Antalya, based on physicochemical parameters. In recent years, this stream was adversely affected by intensive agriculture, farming and domestic wastes and was exposed to various pollutants. Seasonal analyses of physicochemical parameters and sampling of organisms belonging to the order Trichoptera were carried out from six stations selected between November 2015 and June 2016. 6 families, 10 genera and 21 species belonging to order Trichoptera were identified. Similarities between the sampling points were clustered by using Unweighted Pair Group Method with Arithmetic Mean. As a result of the Unweighted Pair Group Method with Arithmetic Mean. analysis, the 4th and 6th sampling point (85%) were the most similar to each other. The Principal Component Analysis was used to determine the factors caused the pollution. The Principal Component Analysis was applied to only physicochemical data sets resulted in three principal components accounting for a cumulative variance of 80.9% of for Ulupınar Stream.
Keywords: *Trichoptera, Ulupınar Stream, water quality, principle component analysis*

Öz

Bu çalışmada Antalya'nın önemli bir turizm bölgesi olan Ulupınar Çayı'nın Trichoptera faunası ve su kalitesinin fizikokimyasal parametrelere göre belirlenmesi amaçlanmıştır. Son yıllarda bu çay yoğun tarım, çiftçilik faaliyetlerinden ve evsel atıklardan olumsuz etkilenmiş ve çeşitli kirletici maddelere maruz kalmıştır. Fizikokimyasal parametrelerin mevsimsel analizleri ve Trichoptera takımına ait organizmaların örneklenmesi Kasım 2015 ile Haziran 2016 tarihleri arasında seçilen altı istasyondan gerçekleştirildi. Trichoptera takımına ait 6 familya, 10 cins ve 21 tür tespit edildi. Örnekleme noktaları arasındaki benzerlikler Aritmetik Ortalamalı Ağırlıksız Çift Grup Yöntemi kullanılarak kümelenmiştir. Aritmetik Ortalamalı Ağırlıksız Çift Grup Yöntemi analizinin bir sonucu olarak, 4. ve 6. örnekleme noktaları (85%) birbirine en çok benzeyen istasyon olmuştur. Kirliliğe neden olan faktörleri belirlemek için Temel Bileşen Analizi kullanıldı. Yalnızca fizikokimyasal veri setlerine uygulanan Temel Bileşen Analizi, Ulupınar Çayı'nın 80,9%'unun kümülatif varyansını oluşturan üç ana bileşene neden olmuştur.
Anahtar kelimeler: *Trichoptera, Ulupınar Çayı, su kalitesi, temel bileşen analizi*

* *Corresponding author*

Introduction

In many countries, the need for water increases while unpolluted water resources are decreasing as a result of the deterioration of usable water resources with various factors. Due to this situation, various policies were developed to ensure the correct use and protection of natural resources both in our country and in other world states. The EU Water Framework Directive (WFD) implemented by the member states of the European Union (EU) is one of these directives. According to WFD, benthic macroinvertebrates are considered as one of the most important indicators. Pauls et al. (2008) stated that among the important benthic macroinvertebrates living in streams, members of order Trichoptera are used as a biological monitoring tool in determining water quality. When sedimentation, industrial pollution, mining and agriculture, sewage waste, acid rains accumulate on the water surface, these organisms are damaged (Graf et al., 2008).

Order Trichoptera are represented approximately with 49 families, 616 genera and 14.548 species in the world (Morse, 2011). Order Trichoptera are represented by 22 families, 461 species and 39 subspecies in Turkey (Darılmaz & Salur, 2015; Küçükbasmacı & Kıyak, 2017; Sipahiler, 2018a). In Turkey, as well as various faunistic studies were conducted to uncover the Trichoptera fauna, in ecological-based studies, the members of this order have been widely investigated as biological indicators. (Çakın, 1983; Darılmaz & Salur, 2015).

Ulupınar Stream, chosen as a study area, is flowed between Olimpos and Çıralı Bays in Antalya. Since the stream is flowed into the intensive tourism areas, many places such as pensions and restaurants are encountered on the stream or its edges.

This study aims to determine species of Trichoptera fauna of Ulupınar Stream, to determine the water quality used by physicochemical parameters and to examine the relationships between physicochemical parameters and Trichoptera species.

Method

Study Area

Ulupınar Stream, which has formed the Çıralı Plain and its coast, is born from the 900 m high slopes in the northwest of Ulupınar Village. The stream, springs from the karstic creeks, flows under the name of Hayıt Creek up to Kumluca - Antalya Highway, and then combines with Kuruseki Creek, coming from the east of Antalya with the branches of Cehennem Creek from the west of Antalya, and flows by name

of Ulupınar Stream. The total length of the stream flowing in a tectono-karstic groove, is about 13 km.

The outfall section, where Ulupınar Stream disombogues into the Mediterranean Sea, generally turns north and sometimes turns south. Since the dominant wind on the shore blows from the southeast direction, the outfall of the stream is mostly shifted to the north. Although plane tree is the dominant vegetation of the valley floor of Ulupınar Stream, and on the slopes of the valley, the dominant vegetation is red pine, almost all species of maquis are common. The characteristics of sampling stations were presented in Table 1.

Collection of Trichoptera Samples

Samples were collected by 20 minutes by kicking and sweeping methods with kick-net (250 µm mesh). The samples were taken from several different sections at each station in order to include all possible microhabitats. All the samples collected were immediately fixed in formaldehyde (4%) in the field. Trichoptera individuals were taken to SDU Hydrobiology Laboratory and stored in 70% alcohol. The obtained samples were examined under a stereomicroscope and evaluated qualitatively and quantitatively.

Edington & Hildrew (1995), Pitsch (1993), Pescador et al. (1995), Wallace et al. (1990), Wiggins (1998), Waringer & Graf (2011) were used in species diagnoses.

Table 1

Key Characteristics of Sampling Stations across Ulupınar Stream

Sampling Station	Coordinates (N-E) and Altitude (m)	Habitat	Stream Morphology	Riparian Vegetation
1	36º 27' N 30º 26' E 245 m	Macrolithal	Macrophyte present	Well-developed on both sides.
2	36º 27' N 30º 26' E 246 m	Microlithal	Macrophyte present	Well-developed on both sides.
3	36º 26' N 30º 26' E 265 m	Macrolithal	Macrophyte present	Not well- developed
4	36º 27' N 30º 26' E 201 m	Megalithal	No Macrophyte present	Not well- developed
5	36º 27' N 30º 25' E 186 m	Macrolithal	Macrophyte present	Not well- developed
6	36º 25' N 30º 26' E 54 m	Microlithal	Macrophyte present	Not well- developed

Physicochemical Parameters

1 L polyethylene sample containers were used for water sample collection. Water samples were taken seasonally between November 2015 and June 2016 from each of the 6 stations. I paid attention to take the samples concurrently.

Water temperature (°C), pH, electrical conductivity (EC) µS/cm and dissolved oxygen (DO) mg/L were measured in the field by using a portable multiparameter (YSI 550A) device. Ammonium nitrogen (NH_4-N) mg/L, Nitrite nitrogen (NO_2-N) mg/L, Nitrate nitrogen (NO_3-N) mg/L, Ortho-phosphate ion (PO_4-P) mg/L, Chloride Ion (Cl^-) mg/L, Biological oxygen demand (BOI_5) (mg/L) were analysed at the University of Süleyman Demirel, Geothermal Energy, Groundwater and Mineral Resources Research and Application Centre.

In this study, physicochemical water quality was determined according to Klee (1991) methods and the Turkish Regulation for Water Pollution Control (WPCR) (2008) of the Ministry of Forestry and Water Management of the Republic of Turkey.

Data Analysis

The faunal similarities based on Trichoptera fauna between the sampling stations were assessed by using the Bray-Curtis similarity index (Sommerfield, 2008; Yoshioka, 2008). UPGMA analysis based on Bray-Curtis similarity index was applied by using the PAST3 software program. All mathematical and statistical analyses on the physicochemical and biological data sets were made by using Excel 2019 (Microsoft Office^R) (Kazi et al., 2009).

Principal Component Analysis (PCA) is a statistical procedure that uses an orthogonal transformation to convert the observation set of interrelated variables into the values of linearly unrelated variables called principal components. In this study, PCA analysis was used to evaluate the statistical correlation between physicochemical variables in Ulupınar Stream.

Results

Physicochemical Variables

The physicochemical variables were recorded seasonally. The maximum, average and minimum recorded values at the stations are given in Table 2.

Table 2

Minimum, Average and Maximum Values of Physicochemical Parameters at the Six Stations in Ulupınar Stream

		DO	pH	T°C	EC	Cl^-	NH_4-N	NO_2-N	NO_3-N	PO_4-P	BOD_5
1	Min.	6.31	7.47	10.9	269.5	5.15	<0.05	<0.01	0.09	<0.05	0.10
	Avg.	8.60	7.84	16.4	355.6	9.35	<0.05	<0.01	0.22	<0.05	1.69
	Max	9.91	8.11	19.7	451.0	19.95	<0.05	<0.01	0.41	<0.05	3.52
2	Min.	6.17	8.03	11.5	272.0	5.87	<0.05	<0.01	0.28	<0.05	0.59
	Avg.	8.01	8.28	16.6	297.1	8.04	<0.05	<0.01	1.20	<0.05	1.88
	Max	9.26	8.5	21.9	333.1	10.52	0.06	<0.01	2.98	<0.05	3.24
3	Min.	6.57	7.97	12.5	237.6	5.84	<0.05	<0.01	0.24	<0.05	0.54
	Avg.	8.40	8.19	15.0	258.4	6.32	<0.05	<0.01	0.34	<0.05	2.42
	Max	9.24	8.46	16.1	286.4	6.96	0,10	<0.01	0.61	<0.05	3.75
4	Min.	6.73	7.94	12.1	291.1	6.34	<0.05	<0.01	0.13	<0.05	0.56
	Avg.	8.68	8.15	16.3	327.9	7.20	<0.05	<0.01	0.30	<0.05	2.40
	Max	9.80	8.37	19.8	385.2	8.54	<0.05	<0.01	0.48	<0.05	4.00
5	Min.	8.44	7.77	12.9	219.0	5.57	<0.05	<0.01	0.15	<0.05	2.31
	Avg.	9.18	8.15	13.9	236.4	7.53	<0.05	<0.01	0.24	<0.05	3.03
	Max	9.99	8.41	14.6	258.6	12.64	<0.05	<0.01	0.31	<0.05	4.00
6	Min.	6.01	7.95	12.2	320.1	14.89	<0.05	<0.01	0.02	<0.05	0.65
	Avg.	7.79	8.08	19.5	427.4	16.9	<0.05	<0.01	0.26	<0.05	2.04
	Max	9.52	8.27	24.3	500.0	19.58	<0.05	<0.01	0.58	<0.05	3.75

When minimum, average and maximum values of physicochemical parameters were evaluated, it was found that the Dissolved Oxygen (DO) values varied with the stations and seasons. Its average values were fluctuated between 7.79 mg/L (station 6) and 9.18 mg/L (station 5). Average pH values were close to each other for 6 stations and all seasons. The lowest average pH value was measured at 1st station with 7.84, and the highest average value was measured at 2nd station with 8.28. The average values of the BOD_5 in the station 5 had the highest value with 3.03 mg/L and in the station 1it had the the lowest value with 1.69 mg/L while the electrical conductivity (EC) values were varied between 236.4 µS/cm (station 5) - 427.4 µS/cm (station 6). The highest ammonium nitrogen (NH_4-N) in Ulupınar Stream was measured as 0.10 mg/L at the 3rd station. NH_4-N value was measured as <0.05 mg/L at all other stations. It has been determined that nitrite nitrogen (NO_2-N) (<0.01 mg/L) and ortho phosphate (PO_4-P) (<0.05 mg/L) values were below the analysis limits. The measured values of nitrate nitrogen (NO_3-N) differed by stations and seasons. Average values were determined between 0.22 mg/L (station 1) and 0.34 mg/L (station 3). The average chloride (Cl^-) ion values varied between 6.32 mg/L (station 3) - 16.9 mg/L (station 6).

The result of the correlation matrix of physicochemical components based on PCA and the biplots, which are the graphical representation of factor loadings in different components (Component 1, Component 2 and Component 3) are given in Figure 1. The PCA was applied on 10 physicochemical parameters for Ulupınar Stream with six sampling stations to determine the variations in water quality. In this study, the eigenvalues were greater than 1 at Component 1, Component 2 and Component 3. The PCA analysis led to the explanation of 80.9% variance in case of Ulupınar Stream. According to Liu et al. (2003), the factor loadings classified as "strong", "moderate" and "weak" corresponding to precise loading values of>0.75, 0.75–0.50 and 0.50–0.30, respectively.

Figure 1

Biplots for PCA analysis of physicochemical water quality in Ulupınar Stream

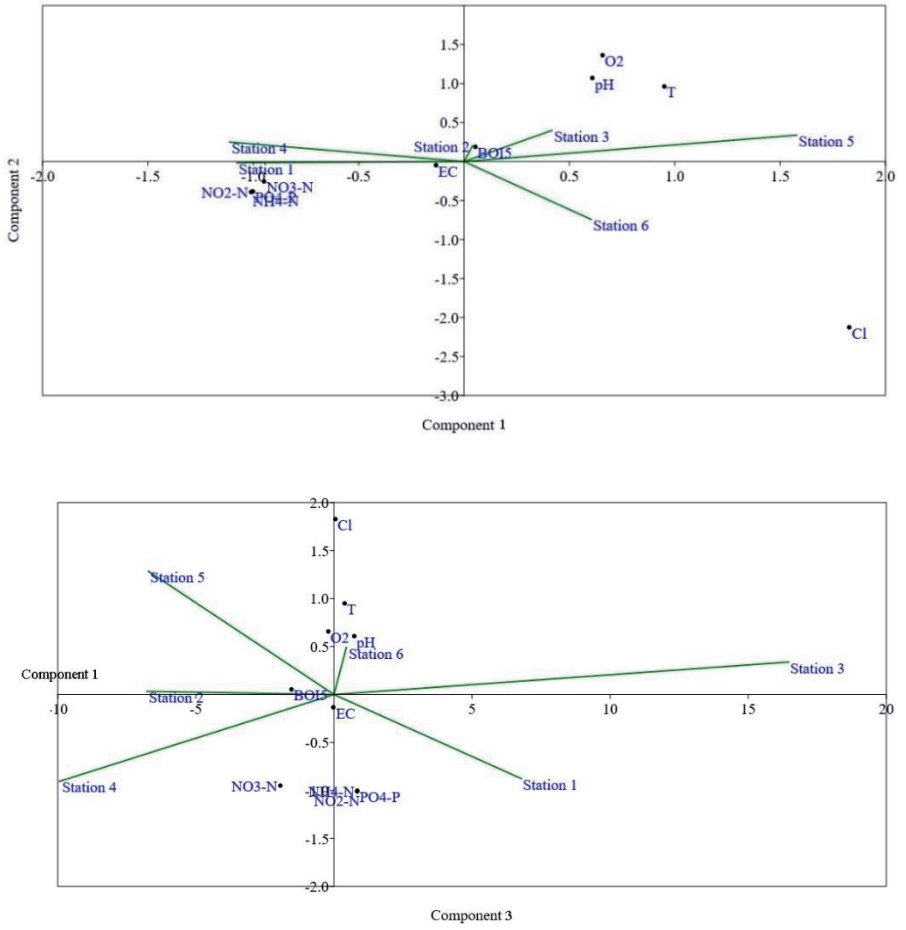
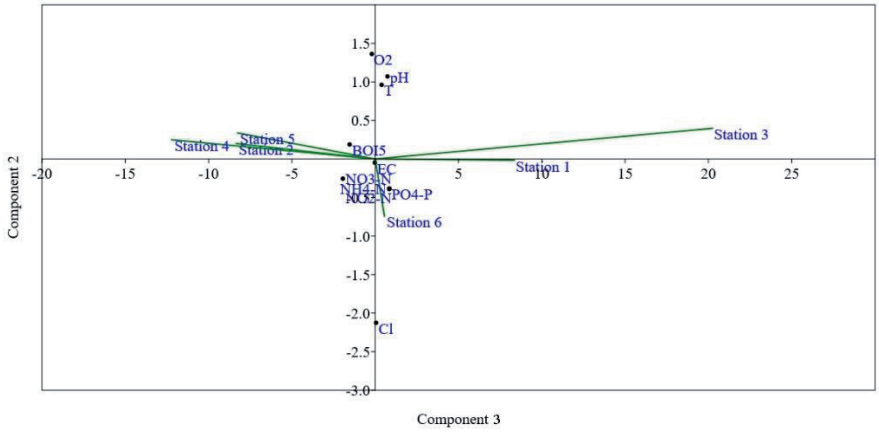


Figure 1

(Continued)



According to the data set pertaining from Ulupınar Stream, among three PCs, the Component 1 explaining 67.7% of the total variance ha strong positive loading on T°C, and Cl^-, moderate positive loading on DO, BOI_5 and pH whereas negative strong loading on NH_4-N, NO_3-N, NO_2-N and PO_4-P. The positive loading on T°C, Cl^-, DO, BOI_5 and pH have been related to pollution. According to Solanki et al. (2010), the opposite relationship between T°C and NH_4-N, NO_3-N, NO_2-N and PO_4-P are a natural process in freshwaters. According to Component 2, 30.8% of total variance has strong positive loading on DO, T°C and Ph. The strong negative loading on Cl^- in component 2. According to Component 3, 23.1% of total variance has strong positive loading on Ph, NH_4-N, NO_2-N and PO_4-P. PCA analysis is a statistical analysis that indicates which parameters are more effective in data with many variables.

Trichoptera Dataset

In this study 10 genera of 6 families belonging to the subgroup of Trichoptera, Annulipalpia, Integripalpia and Scipipalpia, and 21 taxa related to these species were determined. A total of 1.367 individuals were examined. Diagnosis of some 7 genus samples could not be made due to the lack of sufficient resources in the larval diagnostic keys used or because the samples did not complete their development. Taxa given in genus level are *Hydropsyche* sp., *Glossosoma* sp., *Agapetus* sp., *Hydroptila* sp., *Oxyethira* sp., *Rhyacophila* sp. and *Agraylea* sp. The taxa of Trichoptera fauna determined in Ulupınar Stream and their distribution by stations are given in Table 3.

Table 3

Distributions of Trichoptera Taxa in the Stations

	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6
Phylum: Arthropoda Class: Insecta Order: Trichoptera						
Familya: Glossosomatidae						
Agapetus sp.			8		21	
Glossosoma sp.	1			1	1	4
Familya: Hydropsychidae						
Cheumatopsyche lepida	18					1
Hydropsyche fulvipes	9	3	49	140	134	135
Hydropsyche instabilis	2	2				18
Hydropsyche botosaneanui				19		2
Hydropsyche dinarica				6		3
Hydropsyche pellucidula	15	13	12			
Hydropsyche sp.	186	7	30	138	98	159
Familya: Hydroptilidae						
Agraylea multipunctata	1					
Agraylea sp.				7		
Hydroptila occulta				2		1
Hydroptila sp.	22			26	1	9
Oxyethira flavicornis				2		6
Oxyethira sp.	12			3		
Familya: Limnephilidae						
Limnephilus flavicornis			2			
Familya: Rhyacophilidae						
Rhyacophila dorsalis				2	14	2
Rhyacophila obliterata					8	
Rhyacophila pubescens					7	
Rhyacophila sp.	1					
Familya: Sericostomatidae						
Sericostoma personatum				3	1	

The highest number of individuals in Ulupınar Stream was determined at the 4th station (349). In other stations, the ranking was 6th station (340), 5th station (285), 1st station (267) and 3rd station (101), and 2nd station (25) with the lowest number of individuals.

In the 1st station, 267 individuals belonging to a total of 10 taxa were examined. The species with the highest number of individuals is *Hydropsyche* sp. (186), while this taxon *Hydroptila* sp. (22), *Cheumatopsyche lepida* (18), *Hydropsyche pellucidula* (15), *Oxyethira* sp. (12) and *Hydropsyche fulvipes* (9), *Glossosoma sp.* (1), *Rhyacophila sp*. (1) and *Agraylea multipunctata* (1) followed the species.

In the 2nd station, 25 individuals were identified and 13 of these individuals are belonging to *Hydropsyche pellucidula*, 7 individuals are belonging to *Hydropsyche sp.,* 3 individuals are belonging to *Hydropsyche fulvipes,* and lastly 2

individuals are belonging to *Hydropsyche instabilis*. At this station, a total of 4 taxa have been determined and it has the the least taxon among the other stations. Hydropsyche is the dominant breed both in terms of individual number and taxon number.

While determining 5 taxa at the 3rd station, the taxon represented by the highest number of individuals was *Hydropsyche fulvipes* (49), followed by *Hydropsyche* sp. (30), *Hydropsyche pellucidula* (12), *Agapetus* sp. (8) and *Limnephilus flavicornis* (2).

The highest number of taxa (12) and the highest number of individuals (349) in Ulupınar Stream were determined in the 4th station. In the 4th station, taxa according to the number of individuals are *Hydropsyche fulvipes* (140), *Hydropsyche* sp. (138), *Hydroptila* sp. (26), *Hydropsyche botosaneanui* (19), *Agraylea* sp. (7), *Hydropsyche dinarica* (6), *Oxyethira* sp. (3), *Sericostoma personatum* (3), *Hydroptila occulta* (2), *Oxyethira flavicornis* (2), *Rhyacophila dorsalis* (2), *Glossosoma sp.*(1).

In the 5th station, a total of 285 individuals belonging to 9 taxa have been identified and it takes third place in terms of number of individuals. *Hydropsyche fulvipes* (134) has the highest number of individuals among the determined taxa, whereas *Hydropsyche* sp. (98), *Agapetus* sp. (21), *Rhyacophila dorsalis* (14), *Rhyacophila obliterata* (8), *Rhyacophila pubescens* (7), *Hydroptila sp*. (1), *Glossosoma sp*. (1) and *Sericostoma personatum* (1) follow the taxa.

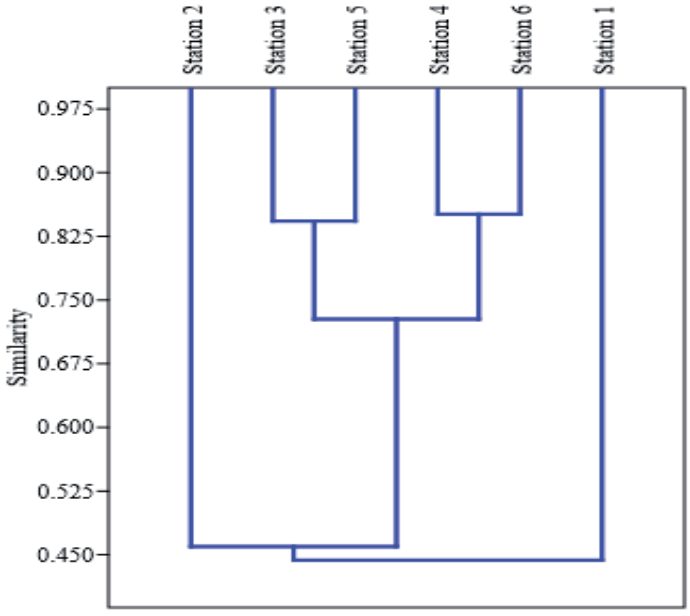
In the 6th station, 11 taxa and 340 individuals belonging to the Trichoptera order were determined and ranked second among the stations in terms of the number of species. While the taxon with the highest number of individuals in this station is *Hydropsyche* sp. (159), this taxon is *Hydropsyche fulvipes* (135), *Hydropsyche instabilis* (18), *Hydroptila* sp. (9), *Oxyethira flavicornis* (6), *Glossosoma* sp. (4), *Hydropsyche dinarica* (3), *Rhyacophila dorsalis* (2), *Hydropsyche botosaneanui* (2) followed by *Hydroptila occulta* (1) and *Cheumatopsyche lepida* (1).

The classification of the stations based on benthic macroinvertebrates composition was illustrated by using Bray-Curtis UPGMA analysis (Figure 2). As a result of the UPGMA analysis, the 4th and 6th stations (85%) were the most similar to each other. The second most similar stations to each other were determined at the 3rd and 5th stations (83%).

As a result of seasonal studies carried out in Ulupınar Stream between November 2015 and June 2016, 516 individuals were found in autumn (November), 239 individuals in winter (February), 452 individuals in spring (March) and 160 individuals in summer (June).

Figure 2

Classification of Stations Based on Similarities of in Ulupınar Stream



Discussion and Conclusion

In fact, water can dissolve certain amounts of oxygen. The ability of water for dissolving oxygen is related with its temperature. Therefore, the cold water dissolves, more oxgen and also is better for living organisms (Jens, 1980). The highest water temperature value was determined at sixth stations with 24.3^0C. In this period, the stream width decreased to 30 cm and depth to about 5 cm. In this study, I found out that the amount of oxygen in Ulupınar Stream changed in parallel with the temperature changes and the flow rate in the stream was determined at very low levels during all sampling periods.

While some of the members of Trichoptera live in mountain streams with high oxygen content and low temperature, some are found in rivers and in lakes (Edington & Hildrew, 1995). In this study, 11 species were identified in February, when the

water temperature was the lowest. Chemical and biochemical reaction rates increase as the temperature increases. While organisms usually survive between certain temperature values, temperature changes cause increase and decrease in development and respiratory rates (Tchobanoglous & Schroeder, 1985).

When the DO value falls below 0.5-1.0 mg/L in water, life in the water stops and values below 4 mg/L of DO cause negative effects on the development of living things (Goldwald, 1965; McNelly et al., 1979). Average DO values recorded at the six stations in Ulupınar Stream vary between 7.49 mg/L and 9.18 mg/L. The highest DO value was determined as 9.99 mg/L at 5th station, the lowest dissolved oxygen value was 6.01 mg/L at 6th station. The lowest T^{o}C value and the highest DO values were determined at the 5th station. This situation shows that the DO values are inversely proportional. At the 6th station, the flow rate is very slow, the amount of water is very low and the amount of DO is determined at the lowest levels due to the absence of shading.

In aquatic systems, living organisms have a tolerance to certain pH ranges and the pH value should vary between 6.5 and 8.5 in unpolluted natural waters (Hem, 1985; Barlas, 1988; Wetzel, 1983) because bicarbonate and carbonic acid work in buffering among these values (Barlas, 1988). Many natural waters are slightly alkaline because they contain carbonate and bicarbonate (Barlas, 2002). The pH value varies between 7.4 (station 1) and 8.5 (station 2) at all stations detected in Ulupınar Stream. According to the pH values, all stations are within the limits for living them and are included in the "Class-I" water quality class according to the WPCR.

Increased pollution in streams causes an increase in the EC values (Kara & Çömlekçioğlu, 2004; Verep et al., 2005; Kalyoncu et al., 2005). The highest EC value at Ulupınar Stream during the study period was measured at the 6th station in June (500 µS/cm). The lowest EC value was measured at the 5th station (356 µS/cm) in March.

Almost all natural waters have a certain amount of CI^- and the amount of CI^- in the beds with unchanged rocks may vary between 10-30 mg/L in natural spring waters (Barlas, 1988; Hütter, 1984). The average CI^- measured at the six stations was 6.32 mg/L at the 3rd station, while its highest value was 16.9 mg/L at the 6th station. These values represent the first class water quality according to the scale of the Klee and WPCR and it is within the limits for natural spring waters.

Ammonium content in water increases due to the deterioration of organic matter, especially organic fertilizer or inorganic fertilization, domestic and industrial wastewater (Egemen & Sunlu, 1996). Ammonium nitrogen average values were measured below the analysis limits at all stations.

While NO_3-N and NO_2-N in the waters may naturally originate from some minerals, the main source is organic substances and nitrogen fertilizers. The increase in organic substances rises the concentration of NO_3-N and NO_2-N, while decreases the amount of DO. Normally, NO_2-N should not be present in drinking and using waters (Baltacı, 2000; Barlas, 2002; Egemen, 2006). The presence of NO_2-N in waters is an indicator of pollution (Barlas, 2002). In all measurements made in Ulupınar Stream, NO_2-N was found below the analysis limits. NO_3-N, which is seen as the most common form of nitrogen in rivers, is found in very small amounts in clean waters and is an important source of nitrogen for plants. As a result of the rainwater washing the agricultural land, the NO_3-N originating from the fertilizers is easily dissolved in the water and mixed with the surface waters and streams (Barlas, 2002). The average NO_3-N values in the six stations ranged from 0.22 mg/L to 1.2 mg/L.

PO_4-P content is around 0.03 mg/L in mountain streams and streams not polluted. If this amount exceeds 0.1 mg/L, contamination can be suspected (Höll, 1979). Domestic wastes, volcanic rocks and soil are among the sources of phosphorus (Baltacı, 2000; Tanyolaç, 2000; Egemen, 2006; Cirik & Cirik, 2008). The PO_4-P value remained below the analysis limits in all field studies carried out at six stations.

The amount of BOI_5 in the oligosaprob region is 1.6 mg/L and it is below in natural waters. As a result of contamination, the BOI_5 value increases and the amount of DO decreases (LAWA, 1980). While BOI_5 values in streams yield the amount of organic matter, it provides the opportunity to compare the pollution rate between streams and stations (LAWA, 1980; Kocataş, 2008). While very high values were not determined in Ulupınar Stream, the highest BOI_5 was measured as 4.00 mg/L at the 4^{th} and 5^{th} stations. The existence of facilities and the effect of environmental pollution are reasons for the increase in values.

As a result of the evaluation made on physicochemical variables, according to Klee (1991), all stations were determined as the average value in the first quality class (*oligosaprob-uncontaminated),* while the first five stations were determined according to the WPCR in the case of the first quality class according to all

parameters. According to the average value of DO, the water quality of the stream was determined as Class II.

Our study conducted on the Trichoptera fauna and water quality in Ulupınar Stream, is the new and recent study for this region. There is any study on Trichoptera fauna and water quality for Ulupınar Stream.

As a result of the studies carried out at the stations, *Agraylea multipunctata* species were found only at the 1st station. The station has an altitude of 245 m, the average TºC values varied between 10.9ºC and 19.7ºC. The taxon found in the first station has a low flow rate in this study. According to Graf et al. (2008), this taxon prefers stagnant waters. According to DIN 38410 (2004), this taxon is dispersed in the betamesosaprob region and was determined in the first quality class in this study.

Cheumatopsyche lepida was found at the 1st and 6th stations. In the Ulupınar Stream, this species ranged between the lowest 54 m altitude and the highest 245 m altitude. The temperature values determined by this taxon varied between 10.9ºC and 19.7ºC. Graf et al. (2008) stated that this taxon is seen in areas higher than 150 m and prefers high flow areas, and average temperature values are given between 8-20ºC. The results obtained from the heights matched up with the literature. According to DIN 38410 (2004), this taxon is an organism that spreads in the *betamesosaprob* region and it was found in the oligosaprob region in this study.

In the study, most individuals belong to the Hydropsychidae family. It is stated that the distribution of Hydropsychidae [*H. fulvipes* (Curtis, 1834), *H. instabilis* (Curtis, 1834), *H. botosaneanui*, *H. dinarica*, *H. pellucidula* (Curtis, 1834)] members, commonly known as a cosmopolitan family, may be different according to factors such as DO, TºC, flow rate (Wiggins & Mackay, 1978; Williams & Feltmate, 1992).

Hydroptila occulta was found at the 4th and 6th stations and it was determined the average TºC values varied between 16,3ºC and 19,5ºC at the stations. In terms of altitude, it has been distributed in the stations with the altitude from 54 m to 201 m. According to DIN 38410 (2004), *Hydroptila* taxa are among the organisms that spread in *betamezosaprob* region. Graf et al. (2008) stated that *H. occulta* is distributed between 150-1900 m altitudes and shows good development in stagnant waters with a temperature of 5ºC-18ºC. Unlike the literature information, there are elevation and temperature differences in this stream.

Limnephilus flavicornis was found only at the 3rd station in summer (June). The average temperature of the station is 15ºC and its altitude is 265 m.

Oxyethira flavicornis was found at the 4th and 6th stations and it has an altitude from 54 m to 201 m and was determined at 16,3ºC and 19,5ºC in terms of average temperatures. Graf et al. (2008) stated that this taxon is distributed in the epirhitral, metarhitral and littoral regions of stagnant and slow flow streams at an altitude more than 150 m.

Rhyacophila dorsalis species was found in the 4th, 5th and 6th stations and the altitudes were determined at stations ranging from 54 m to 201 m. The average temperature values of the stations varied between 13.9ºC and 19.5ºC. While Akyıldız & Duran (2008) express this taxon in Class IV, Keşir (2016) determines it in Class I and Class II quality classes. According to DIN 38410 (2004), these organisms are belonging to the *betamesosaprob* region. The results in this study reveal that it is in Class I quality class. Kalyoncu et al. (2008) stated that they are distributed in Class I quality class.

Rhyacophila obliterata was detected only at 5th station and only in February. The temperature of the station is between 12.5ºC and 16.1ºC. The altitude was determined as 186 m. According to DIN 38410 (2004), these organisms are belonging to the *betamesosaprob* region.

Rhyacophila pubescens was found only in 5th station and in only November. The average temperature value of the station is 13.9ºC. The altitude value is 186 m. According to DIN 38410 (2004), these organisms are belonging to the *oligosaprob* region.

Sericostoma personatum was found in the 4th and 5th stations. The temperatures of the stations varied between 12,1ºC and 19,8ºC. It altitudes were between 186 m and 201 m. Zeybek & Şahin (2016) stated that this species spread in Munzur Stream. According to DIN 38410 (2004), these organisms are belonging to the *oligo-betamesosaprob* region.

In the stream, *Agapetus* sp. was determined at the 3rd and 5th stations while *Glossosoma* sp. was determined at the 1st, 4th, 5th and 6th stations and they show the distribution in *oligosaprob* and *oligo-betamesosaprob* regions according to the saprobi index (DIN 38410, 2004).

Agraylea sp. was determined only at the fourth station, *Hydropsyche* sp. was determined at all stations, *Hydroptila* sp. was determined at the first, fourth, fifth and sixth stations, *Oxyethira* sp. was determined at the first and fourth stations, *Rhyacophila* sp. was determined only at the first station. *Rhyacophyla* taxa are distributed between *oligosaprob* and *betamesosaprob* regions, but are generally organisms of the *oligosaprob* region (DIN 38410, 2004).

Taxa belonging to Trichoptera determined in this study are the new registration for this stream. Also, all stations are free from some or any contaminants in this stream, and according to Klee (1991), all stations are determined at the *oligosaprob* level. I can say that the organisms identified in these streams are distributed in clean or slightly contaminated freshwaters.

Although the majority of the organisms identified in this study distributed in clean or slightly contaminated river sections, species tolerant to organic pollution were also encountered. This may indicate that the working area and the organisms are under pollutant effects. Almost all of the Ulupınar Stream Basin has intense tourism activities. In addition, animal husbandry is done intensely in the region and it is known that the residues formed as a result of these activities are mostly poured into the nearest water environment and streams. Domestic wastes of small villages in the basin are also left uncontrolled to the streams and their surroundings. All these adverse conditions cause an increase in the pollution load of the river basin and affect the biodiversity of the basin as negatively. In this study, it was aimed to determine the Trichoptera fauna and the water quality of Ulupınar Stream. This and similar studies will contribute to establish Turkey's Trichoptera fauna and shed light on other systematic and ecological studies.

Acknowledgement

I would like to thank the General Directorate of Nature Conservation and National Parks of the Ministry of Forestry and Water Affairs, and Süleyman Demirel University Geothermal Energy, Groundwater and Mineral Resources Research and Application Center, which supported me in my work. In addition, I would like to thank the Presidency of Scientific Research Projects Management Unit of Süleyman Demirel University (BAP), which financially supported my thesis with Project No 4433-YL2-15.

References

Akyıldız, G. K., & Duran. M. (2011). Evaluating benthic macroinvertebrate fauna and water quality of Suleymanli Lake (Buldan-Denizli) in Turkey. *Acta Zoologıca Bulgarıca*, *63*(2), 169-178. **http://www.acta-zoologica-bulgarica.eu/downloads/acta-zoologica-bulgarica/2011/63-2-169-178.pdf**

Baltacı, F. (2000). *Water Analysis Methods*. Republic of Turkey Ministry of Energy and Natural Resources, State Hydraulic Works Water and Sewerage Department Printing and Photo-Film Branch Office.

Barlas, M. (1988). *Limnological investigations on the Fulda with special consideration of the fish parasites, their host spectrum and the water quality* [Doctoral dissertation, University of Kassel]. 138.

Barlas, M. (2002). *Water Quality Determination Methods*. Graduate Lecture Notes.

Çakın, F. (1983). Some New Species and Records of Trichoptera in Turkey. *Aquatic Insects, 5*(4), 233-249.

Cirik, S., & Cirik, Ş. (2008). *Limnology*. Ege University Fisheries Faculty Publications, Ege University Press.

Darılmaz, M. C., & Salur, A. (2015). *Annotated catalogue of the Turkish Caddisflies (Insecta: Trichoptera). Munis Entomology & Zoology, 10* (Suppl.), 521-734. **https://www.munisentzool.org/Issue/abstract/annotated-catalogue-of-the-turkish-caddisflies-insecta-trichoptera-994**

DIN 38410. (2004). *Biologisch-ökologische Gewässeruntersuchung* (Gruppe M) - Teil 1: Allgemeine Hinweise, Planung und Durchführung von Fließgewässeruntersuchungen (M1) - Bestimmung des Saprobienindex (M1) Deutsche Einheitsverfahren zur Wasser-, Abwasser- und Schlammuntersuchung, Ausgabe 2004-10. **https://dx.doi.org/10.31030/9569530**

Edington, J. M., & Hildrew, A. G. (1995). *Caseless Caddis Larvae of the British Isles*. Freshwater Biological Association Scientific Publication.

Egemen, Ö. (2006). *Water Quality*. Ege University Press.

Egemen, Ö., & Sunlu , U. (1996). *Water Quality (Textbook)*. Ege University Faculty of Fisheries Publication No: 14, Ege University Press.

Goldwald, S.T. (1965). The egg influx of temporary oxygen deficiency in various stages on the embryonic development of the rainbow trout (Salma gairdneri). *Z. Fischerei, 13,* 63-84.

Graf, W., Murphy, J., Dahl, J., Zamora-Muñoz, C., & López-Rodríguez M.J. (2008). *Distribution and ecological preferences of European freshwater organisms in Trichoptera* (A. Schmidt Kloiber, and D. Hering Eds., Vol. 1). Sofia-Moscow: Pensoft Publishers.

Höll, K. (1979). *Wasser (Untersuchung, Beurteilung, Aufberaitung, Chemie, Bacteriologie, Virologie, Biologie)* 6. Auflage de Gruyter Berlin, New York.

Hem, J. D. (1985). *Study and Interpretation, of the chemical characteristics of natural water* (3rd ed.). United States Government Printing Office.

Hütter, L. A. (1984). *Water and water analysis* (2nded.). Diesterweg Salle Sauerlander.

Jens, G. (1980). *This is how you pull trout*. (4th ed.)Verlag Paul Parey Hamburg-Berlin.

Kalyoncu, H., Barlas, M., Ertan, O.O., & Çavuşoğlu, K. (2005). A study on the change of water quality of Aksu Stream. *Süleyman Demirel University Journal of the Institute of Science, 9* (1), 5-13.

Kalyoncu, H., Yorulmaz, B., Barlas, M., Yıldırım, M. Z., & Zeybek, M. (2008). The effect of water quality and physicochemical parameters of Aksu Stream on macroinvertebrate diversity. *Fırat University Journal of Science and Engineering Sciences, 20* (1), 23-33. **https://www.researchgate.net/profile/Melek_Zeybek/publication/270509324_Aksu_Cayi'nin_Su_Kalitesi_ve_Fizikokimyasal_Parametrelerinin_Makroomurgasiz_Cesitliligi_Uzerine_Etkisi/links/54ac2ab10cf23c69a2b76a00.pdf**

Kara, C., & Çömlekçioğlu, U. (2004). Investigation of Karaçay (Kahramanmaraş) pollution with biological and physicochemical parameters. *Kahramanmaraş Sutcu Imam University Science and Engineering Journal, 7*(1), 1-7.

Kazi, T. G., Arain, M. B., Jamali, M. K., Jalbani, N., Afridi, H. I., Sarfraz, R. A., Baig, J. A, & Shah A. Q. (2009). Assessment of water quality of polluted lake using multivariate statistical techniques: A case study. *Ecotoxicology and Environmental Safety, 72*(2), 301-309. **https://doi.org/10.1016/j.ecoenv.2008.02.024**

Keşir, Ü. E. (2016). Ceyhan River Trichoptera fauna (2016-01) [Master's thesis. Nevşehir Hacı Bektaş Veli University, Institute of Science].**. http://hdl.handle.net/20.500.11787/234**

Klee, O. (1991). *Applied hydrobiology* (2nd ed.)Stuttgart-New York: G. Thieme Verlag.

Kocataş, A. (2008). *Ecology and environmental biology* (10th ed.) Ege University Faculty of Science Textbooks Series.

Küçükbasmacı, İ., & Kıyak, S. (2017). A study on the caddisfly fauna (Insecta: Trichoptera) of Kastamonu and a new species record for Turkey. *Munis Entomology & Zoology*, *12*(2), 486-499. **file:///C:/Users/s.ozturk/Downloads/vol12issue2-4560358.pdf**

Länder-Arbeitsgemeinschaft Wasser (LAWA). (1980). *The water quality map of the Federal Republic of Germany.* Stuttgart, 16.

Liu, C. W., Lin, K. H., & Kuo, Y. M. (2003). Application of factor analysis in the assessment of groundwater quality in a Blackfoot disease area in Taiwan. *Science of the Total Environment,* 313(1–3): 77–89. **https://doi.org/10.1016/s0048-9697(02)00683-6**

McNelly, R. N., Neimanis, V. P., & Dwyer, L. (1979). *Water quality source book, a guide to water quality parameters.* Minister of Supply and Services, Canada, Catalog No: En37-54/1979, 89.

Morse, J. C. (2011). The Trichoptera world checklist. *Zoosymposia, 5*(1), 372-380. **https://doi.org/10.11646/zoosymposia.5.1.29**

Pauls, S. U., Graf, W., Haase, P., Lumbsch, H.T., & Waringer, J. (2008). Grazers, shredders and filtering carnivores-the evolution of feeding ecology in Drusinae (Trichoptera: Limnephilidae): insights from a molecular phylogeny. *Molecular Phylogenetics Evoluation, 46*(2), 776-791. **https://dx.doi.org/10.1016%2Fj.ympev.2007.11.003**

Pescador, M. L., Rasmussen, A. K., & Haris, S. C. (1995). *Identification manual for the caddisfly (Trichoptera) larvae of Florida.* State of Florida Department of Environmental Protection Division of Water Facilities Final Report, 5-46. **http://nebula.wsimg.com/401744dfea0fbc1e94c65722a00f0960?AccessKeyId=95B4E6FC9CD3AA32E410&alloworigin=1&disposition=0**

Pitsch, T. (1993). On the larval taxonomy, faunistics and ecology of Central European flowing water caddis flies (Insecta: Trichoptera). *Series of Publications by the Department of Landscape Development, special issue* 8.

Sipahiler, F. (2018a). Three new species of caddisflies (Trichoptera: Hydroptilidae, leptoceridae) from Turkey and faunistic list for the Seyhan and Ceyhan rivers. *Nova Acta Científica Compostelana (Bioloxía), 25*, 37- 43.

Solanki, S. K., Barthol, P., Danilovic, S., Feller, A., Gandorfer, A., Hirzberger, J., Riethmüller, T. L., Schüssler, M., Bonet, J. A., Martínez Pillet, V., del Toro Iniesta, J. C., Domingo, V., Palacios, J., Knölker, M., Bello González, N., Berkefeld, T., Franz, M., Schmidt, W., & Title, A. M., (2010). *The Astrophysical Journal Letters, 723*(2)**. https://iopscience.iop.org/article/10.1088/2041-8205/723/2/L127/meta**

Somerfield. P. J. (2008). Identification of the Bray-Curtis similarity index: Comment on Yoshioka. *Marine Ecology Progress Series, 372*, 303-306. **https://doi.org/10.3354/meps07841**

Su Kirliliği Kontrolü Yönetmeliği. (2008). **https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=7221&MevzuatTur=7&MevzuatTertip=5**

Tanyolaç, J. (2000). *Limnology*. Hatiboğlu Publishing.

Tchobanoglous, G., & Schroeder, E.D. (1985).*Water Quality.* Mass.Addison-Wesley, 768.

Turkish Regulation for Water Pollution Control (WPCR). (2008). **https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=7221&MevzuatTur=7&MevzuatTertip=5**

Verep , B., Serdar, O., Turan, D., & Sahin, C. (2005). Determination of water quality in terms of physico- chemical structure of the River Iyidere (Trabzon). *Ekoloji, 15*(57), 7-16. **https://app.trdizin.gov.tr/dokuman-goruntule?ext=pdf&path=CrnWZGRsXTjRjLjWxD978OSUAL2jXitizhVYmCxNvH5CjrAQA9r3JaSPjeo4xcPgVNHGqmsNjA2xtdL48IEPvll3ASd6GlNm8_vTAp1C53KyiMeTjBjfBH5yMPhI6AUlvUyzBzbqnDRl8kb2zU3mhLLQRFvDgKLEexwvDxC4CDp7pDKhsls4pw3wBQkQiB9wmSRVLwwNf_Iqjbjvi8HTnoa1l4xvYu1jxYQpDC47fU0=&contentType=application/pdf**

Wallace, A., Wallace, G.A., & Cha, J.W. (1990). Soil organic matter and the global carbon cycle. *Journal of Plant Nutrition, 13*,459–466.

Waringer, J., & Graf, W. (2011). *Atlas of Central European Trichoptera Larvae*. Erik Mauch Publishers.

Wetzel, R. G. (1983). *Limnology*. Sounders College Publishing.

Wiggins, G. B. (1998). *Larvae of the North American Caddisfly Genera (Trichoptera)* (2nd ed.). University of Toronto Press.

Wiggins, G. B., & Mackay, R. J. (1978). Some relationships between systematics and trophic ecologyin nearctic aquatic insects. *Ecology, 59*, 1211 - 1220.

Williams, D., & Feltmate, B. (1992). *Aquatıc Insects,* CAB International, Wallingford.

Yoshioka, P. M. (2008). Misidentification of the Bray-Curtis similarity index. *Marine Ecology Progress Series*, *368*,309-310. **https://doi.org/10.3354/meps07728**

Zeybek, M., & Koşal-Şahin, S. (2016). The Distribution of Trichoptera Assemblages In Relation To Environmental Variables in the Streams of Tunceli (Turkey). *Fresenius Environmental Bulletin, 25*(11), 4972-4981.

Extended Turkish Abstract
(Genişletilmiş Türkçe Özet)

Ulupınar Çayı'nın Trichoptera Faunası ve Su Kalitesi ile İlişkisi

Su canlıların yaşaması için gerekli olan temel ihtiyaçlardandır. Su kaynaklarında günden güne meydana gelen çeşitli sorunlar geri dönüşü olmayacak şekilde su kıtlığına neden olmaktadır. Avrupa Birliği üyesi ülkeler, su kaynaklarının kalite ve miktar yönünden incelenmesi ve korunmasını hedeflemiştir. Aynı zamanda yeraltı ve yerüstü tüm yüzey sularının korunması ve izleme programlarının geliştirilmesi, tüm suların iyi kalite su sınıfına (iyi durum) yükseltilmesini, biyolojik, kimyasal, hidrolojik ve morfolojik açılardan su kalitesinin tanımlanması, nehir havzaları temelinde su yönetiminin oluşturulması, ekonomik enstrümanların, ekonomik analizlerin ve suyun kullanımına dair doğru ekonomik yaklaşımların geliştirilmesi ve geliştirilen nehir havzası yönetimi planlarına vatandaşların, belediyelerin, sivil toplum örgütlerinin zorunlu kamusal katılımın sağlanması gibi birçok hedefleri gerçekleştirmeyi amaçlayarak Su Çerçeve Direktifini (SÇD) hazırlamışlardır. Su ile ilgili tüm unsurları bir çatı altında toplayan SÇD sayesinde su kalitesi, su kütlelerinin ekolojik ve kimyasal özelliklerine göre tespit edilir. Biyolojik kalite unsurlarının durumu suyun biyolojik kalitesi hakkında bizlere bilgi verir.

Daha önce üzerinde çalışma yapılmamış olan Ulupınar Çayı (Antalya) inceleme alanı olarak seçilmiştir. Bu araştırmayı yapma amacımız Ulupınar Çayı'nda bulunan Triphoptera faunasını belirlemek ve belirlenen faunaya göre suyun kirliliğini saptamaktır. Aynı zamanda yapılan fizikokimyasal ölçümlere göre bölgenin kirlilik ile ilgili net sonuçlarına ulaşılmaktır. Trichoptera takımı her tip tatlı su habitatında yaşamaları ve balıklara besin kaynağı olmalarından dolayı su ekosisteminin temel canlıları arasında yer almaktadır. Trıchoptera takımı hızlı akan sularda bulunmakta, aynı zamanda bulunduğu bölgenin ekolojik yapısı hakkında araştırmacılara bilgi vermekte ve kirliliğe karşı duyarlılık göstermektedirler.

Ulupınar Çayı'nda Kasım 2015 - Haziran 2016 tarihleri arasında yapılan çalışmada Trichoptera faunasını ve su kalitesini belirleyebilmek amacıyla arazi şartlarının uygunluğuna göre 6 istasyon seçilmiştir. İstasyonlar akarsudaki karışımları ve etkileşimi yansıtacak şekilde tespit edilmiş ve sürekli akış gösteren yan kollar dikkate alınmıştır. İstasyonların koordinatları ve rakımları GPS yardımı ile ölçülmüştür. Belirlenen istasyonlarda mevsimsel olarak fizikokimyasal su analizi ve Trichoptera takımına ait organizmaların belirlenmesi için örnekler alınmış ve incelenmesi yapılmıştır. Su örnekleri için koyu renkli 1 litrelik polietilen örnek alma kaplarından yararlanılmıştır. Yapılan örneklemelerin yaklaşık olarak aynı saatlerde alınmasına dikkat edilmiştir. Su sıcaklığı (°C), pH değeri, elektrik iletkenliği (µS/cm) ve çözünmüş oksijen (mgO_2/l) ölçümleri arazide portatif multiparametre (YSI 550A) cihazı kullanılarak yapılmıştır. Amonyum azotu (NH_4^+-N), Nitrit azotu (NO_2^--N), Nitrat azotu (NO_3^--N), Orto-fosfat iyonu (PO_4-P), Klorür İyonu (Cl^-), Biyokimyasal Oksijen İhtiyacı (BOI_5) analizleri (mgO_2/l) Süleyman Demirel Üniversitesi Jeotermal Enerji, Yeraltı Suyu ve Mineral Kaynakları Araştırma ve Uygulama Merkezi'nde yaptırılmıştır. Fizikokimyasal değişkenler üzerinden yapılan değerlendirme sonucunda Klee (1991)'ye göre tüm istasyonlar ortalama değer olarak I. kalite sınıfında (oligosaprob-Kirlenmemiş), Su Kirliliği Kontrolü Yönetmeliği'ne (SKKY, 2008) göre yapılan değerlendirmede ilk 5 istasyon tüm parametrelere göre I. kalite sınıfı durumunda belirlenirken sadece 6. istasyon çözünmüş oksijen ortalama değerine göre II. kalite sınıfında belirlenmiştir.

Ölçüm yapılan fizikokimyasal verilerle türler arasındaki ilişki belirlenmeye çalışılmıştır. Sıklık, baskınlık ve benzerlik analizleri incelenerek Ulupınar Çayı'nın su kalitesi hakkında değerlendirme yapılmaya çalışılmıştır. Ulupınar Çayı'nda uygulanan benzerlik indeksi sonuçlarına göre en yüksek benzerlik IV. ve VI. istasyonlar arasında (0,78) görülmüştür.

Yapılan çalışmada Trichoptera takımına ait Annulipalpia, Integripalpia ve Scipipalpia alttakımlarına bağlı, 6 familyaya ait 10 cins ve bu cinslere bağlı 21 tür tespit edilmiştir. Toplam 1367 birey incelenmiştir. 7 cinse ait bazı örnekler teşhisi, kullanılan larva teşhis anahtarları içerisinde yeterli kaynak bulunmaması ya da örneklerin gelişimlerini tamamlamamış olması nedeniyle yapılamamıştır. Cins düzeyinde verilen taksonlar *Hydropsyche* sp.*, Glossosoma* sp., *Agapetus* sp., *Hydroptila* sp., *Oxyethira* sp., *Rhyacophila* sp. ve *Agraylea* sp.*'* dir.

Toplanan örneklerin mevsimsel dağılımına bakıldığında, Kasım ayında 9 takson, Şubat ayında 11 takson, Mart ayında 12 takson ve Haziran ayında 12 takson belirlenmiş, en az takson sayısı Kasım döneminde tespit edilmiştir. Bu taksonların istasyonlara göre dağılımlarında ise 1. istasyonda 10 takson, 2. istasyonda 4 takson, 3. istasyonda 5 takson, 4. istasyonda 12 takson, 5. istasyonda 9 takson, 6. istasyonda 11 taksona rastlanmıştır. En fazla takson 4. istasyonda belirlenirken en az takson 2. istasyonda bulunmuştur.

Saprobi İndeks'e (DIN 38410, 2004) göre Trichoptera faunasının kalite sınıf aralığı oligosaprob ile Beta-Alfamesosaprob arasında değişim göstermektedir. Bu sınırlar saprobi indeksin kalite sınıflandırması olarak I. kalite sınıfı ile II-III. kalite sınıfı arasında değişim göstermektedir. Saprobi değeri olarak en yüksek değere *Cyrnus trimaculatus* (2,5) sahip olurken çok az Trichoptera taksonu 2,3 saprobi değeri üzerine çıkmaktadır. *Hydropsyche* cinsinden ise sadece *Hydropsyche contubernalis* (2,4) beta-alfamesosaprob yani II-III. kalite sınıfına dahil olmakta, Trichoptera takımından hiçbir organizma III., III-IV. ve IV. kalite sınıflarında dağılım göstermemektedir (DIN38410, 2004). Trichoptera takımının üyeleri arasında tüm indekslere göre Hydropsychidae familyası ve familya üyeleri en toleranslı taksonlar durumundadır. Klee (1991)'nin metodu ile fiziksel ve kimyasal parametreler kullanılarak ortalama su kalitesi değerlendirmesi yapılmıştır. Bu değerlendirme sonucunda tüm istasyonlar I. kalite seviyesinde (Oligosaprob) olduğu belirlenmişti. Akarsu üzerinde turizm baskısı olmasına ve balık çiftliklerinin varlığına rağmen akarsu oligosabrob düzeyde belirlenmiştir.

Ulupınar Çayı'nda belirlenen Trichoptera'ya ait taksonlar bu akarsu için yeni kayıt durumundadır. Bu akarsularda belirlenen organizmalar temiz veya az kirlenmiş akarsu bölümlerinde dağılış gösteren organizmalar olduğu söylenebilir.