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The Aquatic Oligochaeta (Annelida) Fauna of the Karasu Stream

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ABSTRACT

Sakarya River is defined hydrologically in three parts: upper, middle and lower Sakarya River Basin. This study was carried out in lower Sakarya River (Karasu). Aquatic Oligochaeta samples were collected from four chosen stations between January 2008 and October 2008 seasonally. In total, eight Oligochaeta species were identified during the study period. These species belong to Naididae family and to Tubificinae subfamily (Tubificoid Naidid) [*Limnodrilus hoffmeisteri* Claparède, 1862; *Limnodrilus udekemianus* Claparède, 1862; *Limnodrilus claparedeianus* Ratzel, 1868; *Potamothenrix hammoniensis* (Michaelsen, 1901); *Psammoryctides deserticola* (Grimm, 1877); *Tubifex blanchardi* Vejdovsky, 1891; *Tubifex ignotus* (Stolc, 1886); *Tubifex tubifex* (Müller, 1774)]. Also, it was observed that *Limnodrilus hoffmeisteri* and *Tubifex tubifex*, were found to be dominant, and thus indicator species for pollution in the river.

Keywords: Oligochaeta, Karasu, Sakarya River

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Karasu Nehri'nin Sucul Oligochaeta (Annelida) Faunası

Öz: Sakarya Nehir havzası; yukarı, orta ve aşağı (Karasu) olmak üzere üç bölüme ayrılır. Bu çalışma Aşağı Sakarya (Karasu) Nehri'nde gerçekleştirilmiştir. Akarsu üzerinde dört istasyon seçilmiş ve bu istasyonlardan Ocak 2008-Ekim 2008 tarihleri arasında mevsimsel periyotlarla Oligochaeta örnekleri toplanmıştır. Çalışma sonunda, Oligochaeta sınıfına ait sekiz tür bulunmuştur. Bu türler Naididae familyasından ve Tubificinae (Tubificoid Naidid) alt familyasıdır [*Limnodrilus hoffmeisteri* Claparède, 1862; *Limnodrilus udekemianus* Claparède, 1862; *Limnodrilus claparedeianus* Ratzel, 1868; *Potamothenrix hammoniensis* (Michaelsen, 1901); *Psammoryctides deserticola* (Grimm, 1877); *Tubifex blanchardi* Vejdovsky, 1891; *Tubifex ignotus* (Stolc, 1886); *Tubifex tubifex* (Müller, 1774)]. Ayrıca çalışmada, kirlilik indikatörü olarak bilinen *Limnodrilus hoffmeisteri* ve *Tubifex tubifex* türlerinin nehirde baskın olduğu gözlenmiştir.

Anahtar kelimeler: Oligochaeta, Karasu, Sakarya Nehri

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Introduction

Sakarya River is the third largest river in Turkey pouring into the Black Sea. Sakarya River basin, which is the most important river in the region, is an important source of natural energy. With the dams built on the area it provides drinking and irrigation water. The length of this river is approximately 810 km and its width 60-150 m. The river is divided into three sections in terms of hydrology: upper, middle and lower Sakarya (Karasu) River Basin (DSI 1992; Anonymous 2015). This river is used for purposes

such as usage water, recreation, agricultural irrigation, and wastewater discharge of residential and industrial establishments. There have been many water pollution problems, due to increase in population and industrialization, and it was determined that some branches of river were significantly contaminated by waste discharges of industrial plants (Dündar 2008; Balcıoğlu and Öztürk 2009). Moreover, the oil pollution level was found higher than the limit value given by UNESCO in Sakarya River (Balcıoğlu and Öztürk 2009).

There are various studies to determine the Oligochaeta fauna in both the lotic and lentic areas of the Sakarya River Basin (Arslan and Şahin 2003, 2004; Arslan et al. 2007; Yıldız et al. 2008). The number of studies is very limited in Karasu Stream on this subject (Arslan and Şahin 2004).

Karasu Stream, which is chosen as a research area in this study, is one of the water sources of the lower Sakarya basin. However, this stream has not been thoroughly investigated in terms of Oligochaeta fauna except a few studies in lentic habitats (Yıldız et al. 2008). Therefore, in this study, it was aimed to determine the Oligochaeta fauna of Karasu River.

Material and Methods

This study was carried out on Karasu River located in the lower part of Sakarya River basin (Turkey). This river is originated from Çataltepe near Hendek. It first flows to north with the name Kabalak Stream. After it merges with Yayla Stream, it takes the name of Karasu and it is poured from Karasu district to the Black Sea. The length of study area is approximately 30 km. Four stations were chosen on this river and samples were taken seasonally between January 2008 - October 2008 (Figure 1). Totally, 16 samples had been performed per site/single sampling from four stations at four seasons.

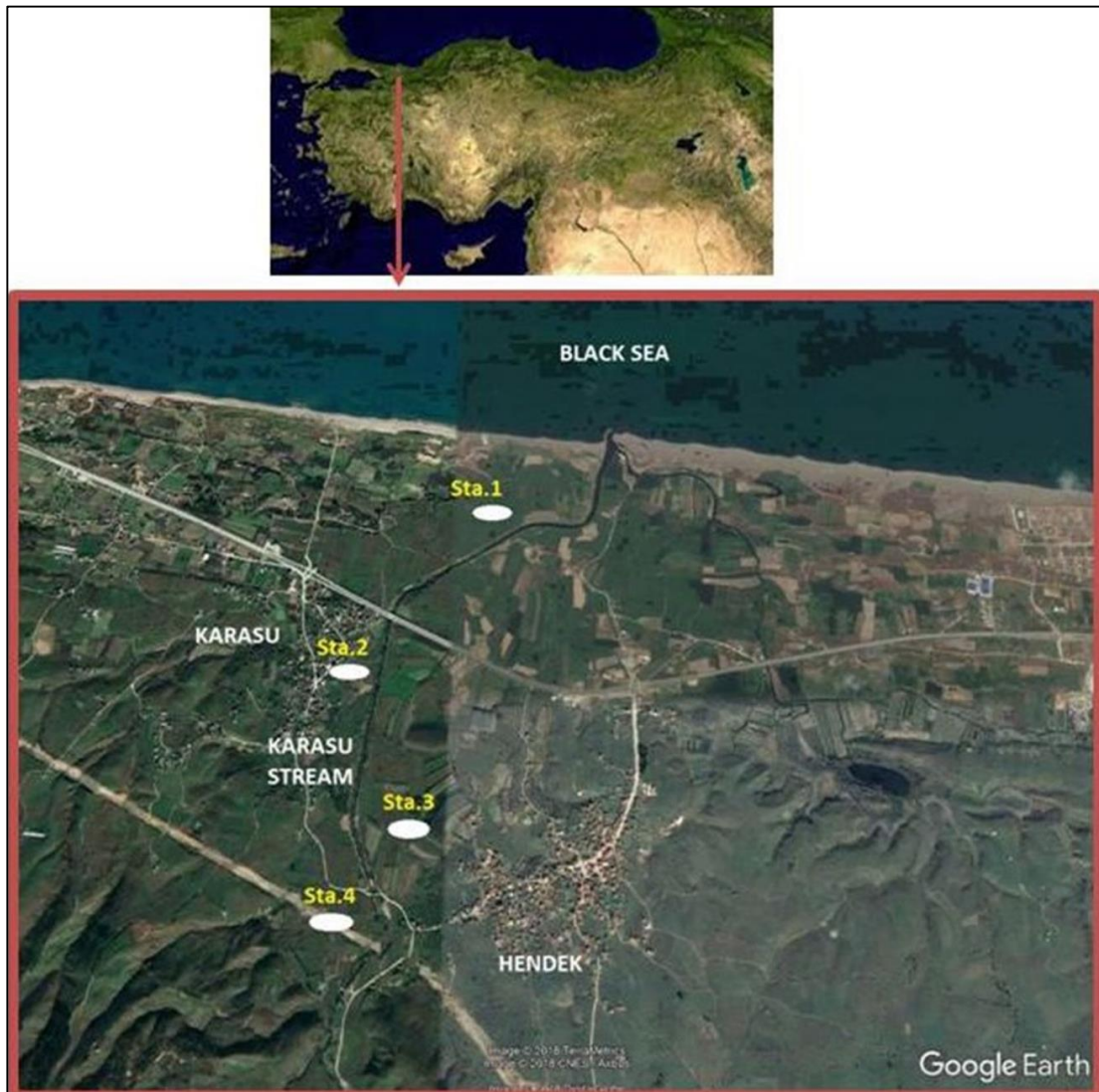


Figure 1. The study area and stations

Oligochaeta specimens were collected twice from each station by using Ekman-Birge grab (15x15 cm) and a hand-net with a mesh size (with sweeping method) 180µm. Then, they were sieved through a mesh of 500µm. The samples

were preserved in the field with 4% formaldehyde solution and preserved in 70 % alcohol until identification after washing in the laboratory. After the permanent preparation of sorted Oligochaeta specimens with CMCP-10

(polyvinyl lactophenol), samples were identified in species level under stereomicroscope and binocular microscopes. Samples were identified according to Brinkhurst and Jamieson (1971), Kathmanand Brinkhurst (1998), Timm (1999),

Timm and Veldhuijzen van Zanten (2002). Shannon-Weaver (1963) and Simpson (1949) indices were applied to detect the species diversity of the stations by using MVSP version 3.1 (Kovach 1998).

Table 1. The Secchi depth values (meter) of the stations.

		Station 1	Station 2	Station 3	Station 4
Secchi Depth (m)	Winter'08	2.3	2.5	4	3.2
	Spring'08	2.3	1.3	4	4
	Summer'08	2.3	1.5	3.8	4
	Autumn'08	2.3	2.5	4	3.2

Results

In total, eight taxa were determined from Naididae family and Tubificinae subfamily (Tubificoid Naidid) at the end of the study.

The list and density of Oligochaeta species at the stations were shown in Table 2. *Limnodrilus hoffmeisteri* was the only taxon seen in all seasons and *L. hoffmeisteri* and *Tubifex tubifex*

were found at the all stations. The species diversity values ranged from 1.27 to 1.5 for Shannon Weaver index and between 0.43-0.6 for Simpson index. In addition, evenness value of the second station was calculated rather low compared to the other stations. Additionally, the lowest diversity value was observed in the autumn and there was only one taxon (Table 2).

Table 2. Seasonal distribution and the density values of the determined taxa.

		Sta 1.	Sta 2.	Sta 3.	Sta.4
OLIGOCHAETA					
Naididae					
Tubificinae					
Winter'08	<i>Limnodrilus hoffmeisteri</i> Claparède, 1862	889	4444	1778	222
	<i>Limnodrilus clapparedeianus</i> Ratzel, 1868		222		
	<i>Limnodrilus udekemianus</i> Claparède, 1862		222	2444	
	<i>Tubifex ignotus</i> (Stolc, 1886)		1110		
	<i>Tubifex tubifex</i> (Müller, 1774)	444		2889	889
	<i>Tubifex blanchardi</i> Vejdovsky, 1891				444
Spring'08	<i>Limnodrilus hoffmeisteri</i> Claparède, 1862			1110	
	<i>Potamotheix hammoniensis</i> (Michaelsen, 1901)			222	
	<i>Tubifex tubifex</i> (Müller, 1774)			2223	
Summer'08	<i>Limnodrilus hoffmeisteri</i> Claparède, 1862		2000		
	<i>Tubifex tubifex</i> (Müller, 1774)	889	444		
	<i>Tubifex blanchardi</i> Vejdovsky, 1891	222			
	<i>Psammoryctides deserticola</i> (Grimm, 1877)	222			
Autumn'08	<i>Limnodrilus hoffmeisteri</i> Claparède, 1862		444		
Species Diversity Indices					
Shannon-Weaver		1.424	1.268	1.502	1.378
Simpson		0.539	0.431	0.59	0.571
Evenness		0.719	0.538	0.786	0.857

The total densities of Oligochaets in each station showed considerable differences during the study period; the highest total density of specimens (7111 ind m⁻²) was recorded at the station 3 in winter period. Oligochaeta species were detected at the third station in the spring while at the second station in the autumn (Fig 2). Most of the determined species, especially the Tubificid ones, are characteristic for eutrophic lakes. In particular, *T. tubifex* and *L. hoffmeisteri* together with *Potamothrix hammoniensis* have high

densities throughout the river. Table 2 clearly shows the eutrophic structure of the river. Also, low Shannon-Weaver values are due to the influence of pollution according to Orclari and Hummon (1975) from high relative intensities of some species according to Statzner 1981; Sang, 1987. In our study, the presence of *L. hoffmeisteri* as the only and dominant species in the second station reduced the value of the diversity index. This information supports the study results.

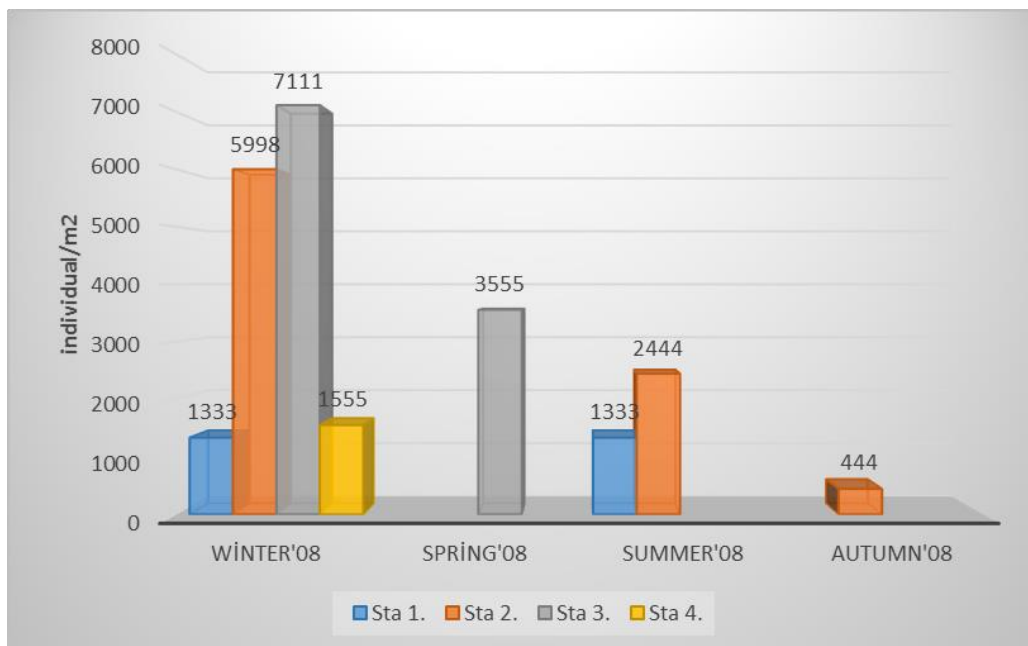


Figure 2. Seasonal abundances of the total Oligochaeta population at the stations during the study.

Discussion

This study was carried out on the Karasu Stream, one of the important branches of the Sakarya River and eight taxa were determined belong to Naididae family and Tubificinae subfamily. Naididae is one of the most important groups of aquatic Oligochaeta and they are cosmopolitan and occur throughout the world (Martin et al. 2008). Especially, taxa in subfamily Tubificinae (Tubificoid Naidid newly) are commonly associated with sediments in aquatic habitats (Yıldız et al. 2012).

Arslan and Şahin (2003) collected Oligochaeta samples from 79 stations on the Sakarya River. Five taxa were determined on Karasu Stream in their work. There are some differences in terms of species composition between those reported by Arslan and Şahin (2003) and the present study. *Ophidonais serpentina*, *Nais pardalis*, *Pristinella jenkiniae*, *Pristina aequisetata*, and *Pristina foreli* were reported from the Karasu Stream. Also, several studies have been carried out to determine the Oligochaeta fauna in several branches of the Sakarya River and lentic

areas of this river basin (Arslan and Şahin 2003, 2004; Arslan et al. 2007; Yıldız et al. 2008). In this study, *L. hoffmeisteri* and *T. tubifex* were found at the all stations.

L. hoffmeisteri is a very common, pollution-tolerant species in freshwaters and it is found in large numbers in densely polluted waters (Brinkhurst and Jamieson 1971; Mason 1996). It happens densely populated in polluted habitats, often together with *T. tubifex*.

T. tubifex is a cosmopolitan species and it is tolerant against organic pollution and lack of oxygen (Klemm 1985; Timm 1999; Yıldız and Balık 2005). According to Milbrink (1983), this species occurs in those environments where competition or predation is weak.

L. hoffmeisteri and *T. tubifex* have poly-sabrobic character (Johnson et al. 1993). These species are the typical species of heavily polluted waters in several indices running on benthic macroinvertebrates (Armitage et al. 1983).

L. udekemianus is a cosmopolitan species and is mostly found in organically polluted waters as well

as oligotrophic habitats (Klemm 1985). This species was found in winter at the second and third stations in this study. This species is often found together with *L. hoffmeisteri* but less in number (Timm 1970).

P. hammoniensis, is a reliable an indicator for eutrophy and it has a wide distribution pattern and can be found in brackish waters occasionally (Milbrink 1980; Lang 1984). In addition, it is known to be extremely tolerant to anoxic conditions in brackish or moderately alkaline bottom water (Milbrink 1980). This species was found only at the third station and had a low dominance in this study. Milbrink (1973) found this species generally associated with pollution and most often together with *T. ignotus* (Stolc 1886), which has Palaearctic distribution in Swedish waters after (Milbrink 1980), is found great rivers and deep lakes.

T. blanchardi is a freshwater tubificid, often occurring together with *T. tubifex* (Marotta et al. 2009). It has a large tolerance range and can live in various habitats (Yıldız 2003). In certain conditions, pH, salinity, mercury and hardness concentrations make stress on *T. tubifex* specimens and induce a gradial loss of hair and pectinate setae thus generating individuals similar to “blanchi” form (Marotta et al. 2009).

L. clapparedeianus Ratzel, 1868, which is freshwater species with tolerance for slightly brackish water, and *Psammoryctides deserticola* (Grimm 1877), which is common, euryhalin and Ponto-Caspian immigrant species have the least dominance value in that study. *L. clapparedeianus* and *P. deserticola* were observed only at stations 2 and 3, respectively.

Findings from this preliminary study on the taxonomic determination of the Karasu Stream Oligochaeta fauna suggest that the species forming the river fauna are generally cosmopolitan, or at least species with broad distribution in the Palearctic region (Timm, 1980). The results show that the river does not have a high diversity in terms of the Oligochaeta fauna.

Although there is no measurement of water quality and pollutants in the study, in the molluscan study conducted in the same region; according to the results of the seasonal measurements of nitrite, nitrate nitrogen, water temperature and pH measurements of the Lower Sakarya River where the survey was conducted according to the Water Quality and Control Regulation (SKKY) (2004), it falls into the category 3 (contaminated water) (Koşal-Şahin 2013). The pollution indicators Oligochaets like *L. hoffmeisteri* and *T. tubifex* were observed in high numbers and have a great

dominancy especially at stations 2 and 3 where pollution level was high.

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