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The Oligochaeta (Annelida) Fauna of Yuvarlak Stream (Köyceğiz-Turkey)

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Abstract

To detect the distribution of Oligochaeta fauna of Yuvarlak Stream in the Köyceğiz-Dalyan protected area in South-Western Turkey, monthly samplings were made from 11 stations from May 2001 to April 2002.

The samples were collected by using 180 µ and 500 µ mesh size hand nets and an Ekman-Birge Grab in 9th and 10th stations.

As a result of the study, totally 50 taxa comprised of 17 species from Tubificidae, 28 species from Naididae, 3 species from Enchytraeidae and 2 species from Lumbriculidae were determined.

Tubifex newaensis, Nais alpina and *Nais behningi* are new records for the inland water fauna of Turkey.

Key words: Oligochaeta, fauna, Yuvarlak Stream, Turkey.

Introduction

Oligochaetes often are the most diverse and or abundant group of benthic invertebrates in freshwater systems, including small streams, large rivers, marshes, ponds, lakes, springs and groundwaters (Wetzel *et al.,* 2000).

Studies on the Oligochaeta fauna in Turkey are not sufficient at present and there were no previous detailed studies related to the Oligochaeta fauna of Yuvarlak Stream, which is one of the major surface waters in the basin, draining various geologic units in to the meromictic Lake Köyceğiz, which in turn discharges to the Mediterranean Sea via a 14 km long meandering channel (Kazancı and Dügel, 2000).

Yuvarlak Stream, which is one of the most important rivers joining to Köyceğiz Lake has both economic and ecological significance. Apart from tourism activities, the fact that it hosts to the biggest trout farm in our country is another indicator of its economic significance (Balık *et al.,* 2005).

Irregular flow regime, which is observed in most of the rivers in our country is not observed in Yuvarlak Stream. Ecological diversity is remarkable because of continuous water flow during annual period. Drainage area of the river is under anthropogenic influence from settlement and industrial plants located in its basin (Balık *et al.,* 2005).

There are a few studies about the invertebrate fauna of Yuvarlak Stream and its vicinity. Among them, pioneer was reported by Kazancı *et al.* (1992) on the Limnology of Lake Köyceğiz. In a part of the study, Lake Köyceğiz and surrounding freshwaters were investigated.

The second one, by Kazancı and Dügel (2000), was on the water quality of Yuvarlak Stream. In general, this study focused on the physico-chemical characteristics of the stream and is determining the water quality by using some indices that consider the invertebrate fauna of the stream. In this respect, Oligochaetes were given at the family level.

Barlas *et al.* (2000) also investigated Yuvarlak Stream from physico-chemical and biological aspects. Similar indices to those in Kazancı and Dügel (2000) were used to determine the water quality of the stream. Only *Eiseniella tetraedra tetraedra* was given as a member of Oligochaeta fauna of the stream.

Balık *et al.* (2005) approved a study determining the pollution level of Yuvarlak Stream by using benthic macro invertebrates. In a part of this study, oligochaetes were given at family level, as *Tubificidae, Naididae, Lumbriculidae, Enchytraeidae* and *Lumbricidae*.

The objective of the present study was to examine the Oligochaeta fauna and distribution pattern of Oligochaeta in Yuvarlak Stream.

Materials and Methods

In this study, 11311 specimens of aquatic Oligochaeta were collected at 11 stations along Yuvarlak Stream (Figure 1, Table 1) on monthly basis between May 2001 and April 2002.

Samples were collected by 500 µm mesh size hand-net and Ekman Birge grab (at the last 2 stations) and were preserved in 4% formaldehyde solution in the field. Materials sampled from last two stations were washed with water in sieve 500 µm mesh size, then brought to the laboratory, sorted under a

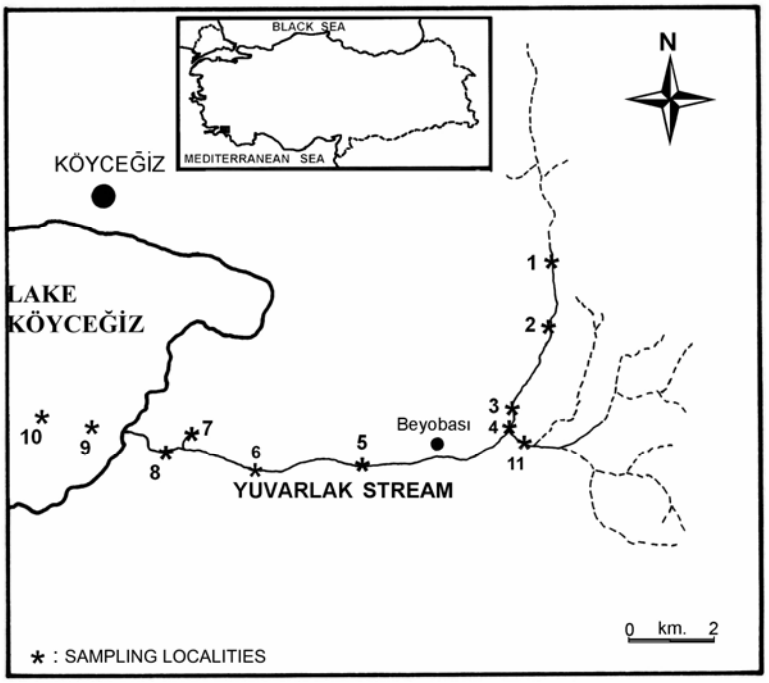

Figure 1. Study area and sampling stations.

Table 1. Sampling stations and their coordinates

Stat. No	Locality	Coordinates
1	Source of Yuvarlak Stream	36° 56' 50" N 28° 48' 37" E
2	Before Trout Farm	36° 56' 19" N 28° 48' 37" E
3	Trout Farm (Pond A1)	36° 54' 56" N 28° 47' 50" E
4	After Trout Farm	36° 54' 48" N 28° 47' 53" E
5	Beyobası Village	36° 54' 21" N 28° 45' 30" E
6	Before Nasıf Dede Stream	36° 54' 22" N 28° 43' 30" E
7	Nasıf Dede Stream	36° 54' 34" N 28° 42' 18" E
8	After Nasıf Dede Stream + River Mouth	36° 54' 39" N 28° 41' 31" E
9	Lake Köyceğiz + Beyond the River Mouth	36° 54' 36" N 28° 41' 18" E
10	Lake Köyceğiz	36° 54' 38" N 28° 41' 07" E
11	Karaboğsak Stream	36° 54' 39" N 28° 47' 47" E

binocular microscope and transferred to 70% ethyl alcohol. Samples were examined by preparing temporary preparation with Amman's Lactophenol. All the samples were deposited in the collection of Ege University Faculty of Fisheries.

For taxonomical identification of the specimens, Sperber (1950), Nielsen and Christensen (1959), Brinkhurst (1971), Brinkhurst and Jamieson (1971), Brinkhurst and Wetzel (1984), Kathman and Brinkhurst (1998), and Timm (1999) were used.

Results

As a result of the study 50 taxa were determined. Distributions of the determined taxa by the stations are shown in Table 2.

According to the number of individuals, Tubificidae (77%) is the predominant family in the stream. Naididae (21%), Enchytraeidae (1.6%) and Lumbriculidae (0.4%) followed it. When the numbers of species of the families were compared, Naididae (28 species) is the predominant family in the stream.

Species richness was high in the study area; because water flow is continuous throughout the year. Regarding the species richness of the stations, Station 4 (29 species) was the richest station followed by Station 8 (24 species), Stations 5 and 7 with 13 species. There was no oligochaeta species at Station 1, 2 and 3 (Table 2).

Among the 50 oligochaeta taxa found at 11 stations, *Tubifex tubifex* (at 7 sites) was the most abundant followed by *Potamothrix hammoniensis* (at 6 sites) of Tubificidae and *Nais elinguis* (at 6 sites) of Naididae.

Tubifex newaensis, Nais alpina and *Nais*

Table 2. Distributions of the determined taxa according to the stations

No	Species	Stations										
		1	2	3	4	5	6	7	8	9	10	11
	Naididae											
1	*Chaetogaster diaphanus* (Gruithuisen, 1828)				+							
2	*Chaetogaster diastrophus* (Gruithuisen, 1828)				+							
3	*Dero digitata* (Müller, 1773)								+			
4	*D. obtusa* d'Udekem, 1855								+			
5	*Ophidonais serpentina* (Müller, 1773)				+			+	+			
6	*Stylaria lacustris* (Linnaeus, 1767)					+	+	+	+			
7	*Paranais litoralis* (Müller, 1784)								+	+	+	+
8	*Paranais frici* Hrabe, 1941									+	+	+
9	*Paranais botniensis* Sperber, 1948									+		
10	*Nais alpina* Sperber, 1948				+	+						
11	*Nais bretscheri* Michaelsen, 1899					+						
12	*Nais communis* Piguet, 1906				+				+			
13	*Nais elinguis* (Müller, 1773)				+	+	+	+	+			+
14	*Nais pardalis* Piguet, 1906				+				+			
15	*Nais pseudobtusa* Piguet, 1906				+	+			+			
16	*Nais simplex* Piguet, 1906				+	+						
17	*Nais variabilis* Piguet, 1906					+			+			
18	*Nais barbata* Müller,1773				+	+						
19	*Nais behningi* Michaelsen,1923							+				
20	*Uncinais uncinata* (Ørsted, 1842)				+							
21	*Pristinella jenkinae* (Stephenson, 1931)					+			+			
22	*Pristinella acuminata* Liang, 1958				+							
23	*Pristinella sima* (Marcus, 1944)				+							
24	*Pristinella rosea* (Piguet, 1906)						+					
25	*Pristina menoni* (Aiyer, 1929)				+							
26	*Pristina bilobata* (Bretscher, 1903)				+				+	+		
27	*Pristina aequiseta* Bourne, 1891				+							
28	*Allonais gwaliorensis* (Stephenson, 1920)				+							
	Tubificidae											
29	*Tubifex tubifex* (Müller,1774)				+	+		+	+	+	+	+
30	*Tubifex ignotus* (Stolc,1886)				+					+		
31	*Tubifex nerthus* Michaelsen, 1908				+				+	+		
32	*Tubifex montanus* Kowalewski, 1919				+							
33	*Tubifex newaensis* (Michaelsen, 1903)								+			
34	*Limnodrilus hoffmeisteri* (Claperede, 1862)					+		+	+	+		
35	*Limnodrilus udekemianus* Claperede, 1862				+			+	+			
36	*Limnodrilus profundicola* (Verrill, 1871)							+				
37	*Potamothrix bavaricus* (Öschman, 1913)				+			+	+	+		
38	*Potamothrix hammoniensis* (Michaelsen, 1901)				+			+	+	+	+	+
39	*Potamothrix bedoti* (Piguet, 1906)								+	+	+	
40	*Potamothrix heuscheri* (Bretscher, 1900)								+	+	+	
41	*Ilyodrilus frantzi* Brinkhurst, 1965				+			+				
42	*Ilyodrilus templetoni* (Southern, 1909)				+				+		+	
43	*Psammoryctides deserticola* (Grimm,1877)				+			+				
44	*Psammoryctides albicola* (Michaelsen, 1901)							+				
45	*Aulodrilus limnobius* Bretscher,1899						+					
	Enchytraeidae											
46	*Enchytraeus coronatus* Nielsen and Christensen, 1959					+						
47	*Mesenchytraeus sp.*						+					
48	*Henlea ventriculosa* (d"Udekem, 1854)				+	+	+					
	Lumbriculidae											
49	*Tatriella slovenica* Hrabe, 1936				+							
50	*Lumbriculus variegatus* (Müller, 1774)								+			

behningi are new records for the inland water fauna of Turkey.

Morphometric, biological and ecological characteristics and the distribution of Oligochaeta species that are specified as new records for the inland water fauna of Turkey are as follows; (L: Total length, S: Number of segments).

***Tubifex newaensis* (Michaelsen, 1903)**

Morphometric Characteristics: L= 78 mm, S = 45 (Figure 2 a,b)

Big, smooth, pink, red or bluish worms. Chaetae bifid with shorter upper tooth; anterior chaetae 3-8 per bundle, 90-170 µm long, sometimes with rounded teeth, or blunt tip without any teeth. No ventral chaetae in XI near male pores in mature worms.

Distribution: Western Palaerctic (originally the Ponto-Caspic basin), Great Lakes of North America; only invading North-west Europe (Timm and Veldhuijzen van Zanten, 2002).

Ecology: In freshwater, particularly on sandy bottom of large rivers (Timm and Veldhuijzen van Zanten, 2002).

***Nais behningi* Michaelsen, 1923**

Morphometric Characteristics: L= 4 mm, S = 25 (Figure 2c, 2d, 2e)

Dorsal chaetae hairs and needles are 1-2 per bundle, needles with thin, simple-pointed distal end. Stomachal dilatation is sudden. Ventral chaetae of II-V, 6-10 per bundle, longer, straighter and half as thick as the rest, upper tooth enormously long, strongly curved, lower tooth reduced or vestigial; those following 2-5 per bundle, with nodulus slightly proximal and upper tooth twice as long as and thinner than the lower.

Distribution: Holarctic (Timm and Veldhuijzen van Zanten 2002).

Ecology: In freshwater, mostly in large rivers on sand (Timm and Veldhuijzen van Zanten 2002).

***Nais alpina* Sperber, 1948**

Morphometric Characteristics: L= 3.8 mm, S = 16 (Figure 2f, 2g, 2h)

Whitish opaque, sometimes with brown pigment

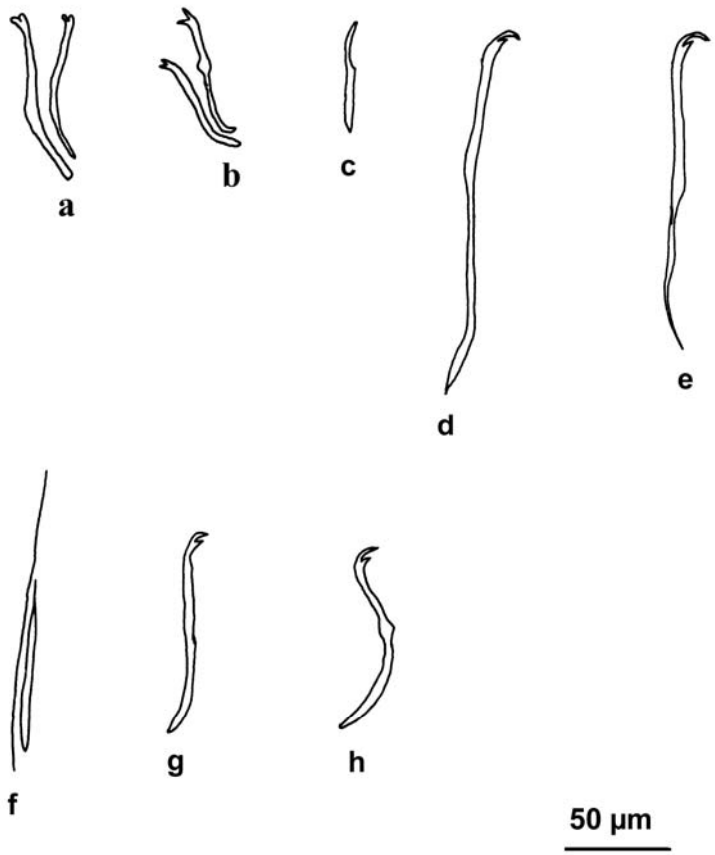

Figure 2. Some chaetal characteristics of new records (a- *Tubifex newaensis* III. ventral seta; b- *Tubifex newaensis* posterior ventral seta; c- *Nais behningi* needle chaetae; d- *Nais behningi* II. ventral chaetae; e- *Nais behningi* posterior chaetae; f- *Nais alpina* hair and needle chaetae; g- *Nais alpina* anterior ventral chaetae; h- *Nais alpina* posterior ventral chaetae).

anteriorly. Dorsal chaetae needles are 1-2 per bundle obtusely simple pointed, hairs are 1-2 per bundle. Ventral chaetae of II-V, 4-7 per bundle, longer, straighter and thinner than the rest, with teeth equally thick, upper tooth twice the length of the lower and nodulus in proximal; in the following segments 3-7 per bundle, with nodulus distal and upper tooth half as thick as lower.

Distribution: Europe, Great Lakes of America (Timm and Veldhuijzen van Zanten, 2002).

Ecology: In freshwater, mostly in cool streams (Timm and Veldhuijzen van Zanten, 2002).

Discussion

The family Tubificidae, with origins in the northern temperate zone (Timm, 1980) was represented by 6 genera in this study. This family and several of its genera (e.g. *Tubifex, Limnodrilus* and *Aulodrilus*) are considered to be cosmopolitan, genus *Potamothrix* is widely distributed throughout the world (Wetzel *et al.,* 2000) and other genera (*Ilyodrilus* and *Psammoryctides*) are distributed in holarctic (Timm and Veldhuijzen van Zanten, 2002).

The most common species is *Tubifex tubifex* in this study; a cosmopolitan species that is not commonly encountered, is locally abundant in habitats of marginal water quality-pristine alpine and subalpine lakes (Klemm, 1985), the bottoms of large, unproductive, oligotrophic lakes, grossly polluted and organically enriched sites with low oxygen tensions, and aquatic habitats supporting few other species (Brinkhurst, 1996). In areas with heavy organic pollution, *T. tubifex* is usually associated with *L. hoffmeisteri*, where the two species are often the dominant oligochaetes or even the dominant or exclusive benthic invertebrates (Brinkhurst, 1996). Brinkhurst (1970) also suggested that *T. tubifex* may prefer situations in which other species find it difficult to survive - either because there is too little active decomposition, or too much. *Limnodrilus hoffmeisteri*, a cosmopolitan species, is perhaps the most commonly collected freshwater oligochaete throughout the worldwide. It occurs in a wide variety of surface water habitats, reaching very high abundance in organically enriched areas - often with *Tubifex tubifex* (Brinkhurst, 1975). These two species were found together at three stations (stations 7, 8 and 9) in Yuvarlak Stream showing consistency with the data given above. *Limnodrilus udekemianus*, a cosmopolitan species, is often found in organically polluted waters as well as oligotrophic habitats (Klemm, 1985). This species also found together with *T. tubifex* at 3 stations (4, 7 and 8) in this study.

Potamothrix hammoniensis, the second most abundant species in this study, is a freshwater euryhalin form (Grigelis, 1980). It has a wide distribution pattern and can be found in brackish waters occasionally. Occurrence of the species at Station 4, 7, 8, 9, 10, 11 (stations 4, 7, 8 and 11 have oligohalin characteristics, 9 and 10 have mesohalin characteristics) supports the ecological data.

The Naididae, which also originates from the northern temperate zone (Timm, 1980), was represented by 10 genera in this study. Most naidid species are also cosmopolitan, occurring throughout the world (Wetzel *et al.,* 2000) and they have clearly adapted to a wide range of environmental conditions (Brinkhurst and Jamieson, 1971). The major part of the naidid fauna of the Yuvarlak Stream was represented by *Nais elinguis*. The species is well recognized as a species of organic pollution (Brinkhurst, 1971) and has been reported to occur in salinities up to 18‰ (Bagge, 1969). In this study, this species was found at Station 4 to 8 and 11 (station 4, 5, 6 and 11 were freshwater habitats and 8 was river mouth-brackish water habitat). This knowledge is consistent with our findings.

The Lumbriculidae is a thermophobe family of the northern temperate zone (Timm, 1980) and was represented by two species in this study (*T. slovenica* and *L. variegatus*). *L. variegatus* has very wide ecological valence; it occurs in the littoral zones of lakes, in running waters, springs, ponds and pools, also in bog waters and ephemeral pools which are unsuitable for the majority of Oligochaeta (Timm, 1970). *Tatriella slovenica* is found in freshwater habitats as a rare species.

The Enchytraeidae is a cosmopolitan family and found from the polar regions to the tropics, from the bottom of lakes and rivers to the bottoms of the oceans, in permanent ice (glaciers) or snow, in permafrost soils, in abundance in sewage trickle filter beds, in pristine marine sands, in large numbers in water-logged soils and through the range of soil types to all but the dried deserts (Wetzel *et al.,* 2000). In this study, this family was represented by three genera (Enchytraeus, Mesenchytraeus and Henlea). *E. coronatus* and *H. ventriculosa* are found in soil and in freshwater near the shore.

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