World Journal of Fish and Marine Sciences 7 (1): 69-73, 2015
ISSN 2078-4589

DOI: 10.5829/idosi.wjfms.2015.7.1.9366

Rotifer Fauna of Gediz River Basin, Turkey

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Abstract: In this study a total of 17 stations from Gediz River Basin were investigated along with the physicochemical parameters in the basin. 22 species of Rotifera were recorded. It was found that was *Keratella tecta*, *K. cochlearis*, *Polyarthra dolichoptera* and *P. vulgaris* were the most common Rotifera species. It was found that the branches leading to Gediz River were the main sources of phosphorus load.

Key words: Nutrient · Water Management · Gediz River · Nitrate · Zooplankton

INTRODUCTION

The food chain in the aquatic ecosystems and the importance of the zooplankton in water bodies has been well documented [1, 2]. The zooplankton has a special place due to its role as a nutrient for fish larvae and aquatic invertebrates. Furthermore, the species composition and abundance values of rotifers are excellent tools for interpreting the trophic level in a given water body, since they are very sensitive to environmental variables such as nutrients [3-5] and they can be observed in a wide range of water bodies from temporary water bodies to great dam lakes. Although, great effort has been done on the zooplankton taxonomy and ecology [6-10] most of those studies deal with lacustrine zooplankton; riverine zooplankton seem to be neglected. Besides, up to date there is no rotifer record from Gediz River Basin. In this study it was aimed to present a faunistic report on the rotifer species of Gediz River Basin, along with the physicochemical parameters.

MATERIALS AND METHODS

The rotifer samples were collected vertically with a Hensen type plankton net (mesh size 55 µm, mouthdiameter 25 cm, length 50 cm) from 17 different sampling stations on June 2013. The sampling stations and coordinates are shown on Figure 1. The samples were fixed within 4% formaldehyde solution. Rotifera species were examined under the inverted microscope (Leica) and identification of the species was made according to Kolisko [11], Koste [12] and Segers [13].

The physicochemical parameters, temperature, electrical conductivity (EC), pH, dissolved oxygen (DO), total phosphorus (TP), total nitrogen (TN), nitrate (NO_3) and nitrite (NO_2) levels were also measured. Of these parameters, dissolved oxygen and temperature were measured with YSI 51 B oxygen-meter, pH with WTW 340-A/SET-1 pH-meter and electrical conductivity was measured with a WTW LF 92 conductometer, The water samples were taken from the surface (TS ISO 5667-6) with a plastic bottle and the total phosphorus, total nitrogen, nitrate and nitrite levels were measured within a few hours after collection according toTS EN ISO 17294 (1-2), SM 4500 N, EPA Method 352.1 (EN ISO 10304-3) and SM 4500-NO_2, respectively.

RESULTS

A total of 22 Rotifer species was recorded from the stations investigated (Table 1). The species distribution in the sampling stations is also given in Table 1. The most common rotifer species were *Colurella adriatica*, *Keratella cochlearis* and *Lecane hamata* among the stations. No rotifer species was observed in stations 2, 10 etc., 13, 14 and 17 and the highest number of species was recorded in station 4 with 7 species (Table 1).

The physicochemical parameters in the surface waters are summarized in Table 2. The water temperature ranged between 11.4 to 27.6 °C, EC 275 to 2679 µS/cm, DO 1.50 to 9.39 mg/L and pH 8.02 to 8.95. Total phosphorus levels was below detection limits in station 1 and 2 and it ranged between 0.11 to 2.54 mg/L, total nitrogen levels were below detection limit in stations 4, 12, 14, 15, nitrate levels

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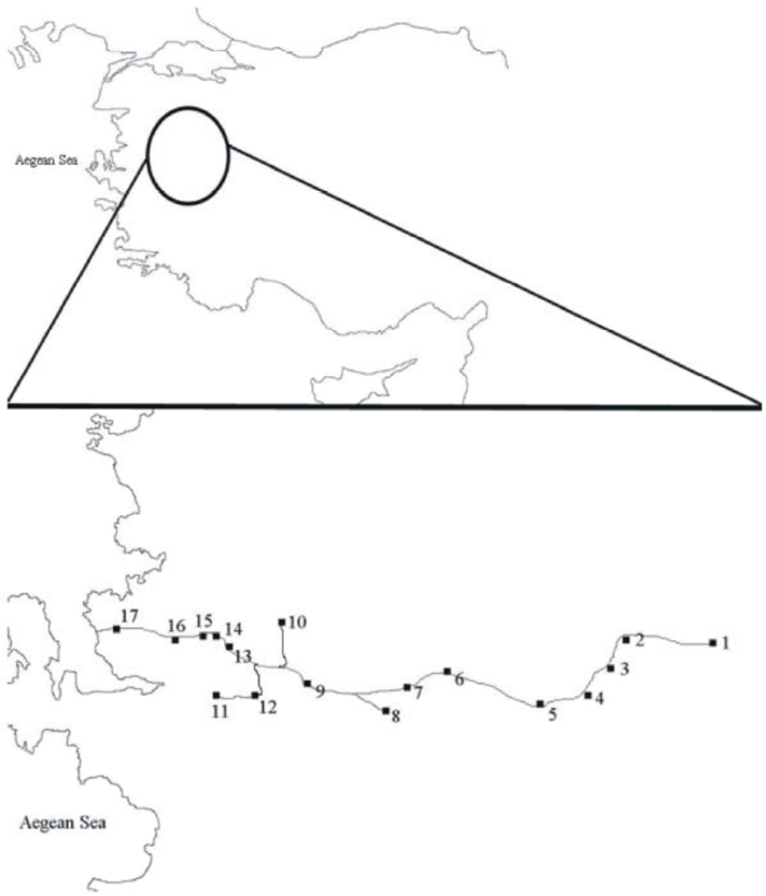

Fig. 1: The map showing sampling localities and coordinates in Gediz River Basin

1. 38° 58' 11.71"N 29° 42’ 53.96"E *10.* 38° 46' 08.91"N 27° 39’ 57.37"E
2. 38° 55' 35.72"N 29° 18' 11.99"E *11.* 38° 26' 45.41"N 27° 25' 29.38"E
3. 38° 48' 56.28"N 29°15' 05.55"E *12.* 38° 29' 03.84"N 27° 36’ 20.66"E
4. 38° 41' 38.05"N 29° 09’ 55.65"E *13.* 38° 38' 35.96"N 27° 26’ 25.78"E
5. 38° 37' 56.63"N 28° 56' 59.73"E *14.* 38° 40' 18.36"N 27° 22’ 09.16"E
6. 38° 41' 40.88"N 28° 29' 23.33"E *15.* 38° 39’ 40.97"N 27° 18’ 44.03"E
7. 38° 37' 01.46"N 28° 18' 30.46"E *16.* 38° 37' 46.20"N 27° 10’ 39.59"E
8. 38° 30' 24.54”N 28° 14' 04.77"E *17.* 38° 37' 20.46"N 26° 53’ 45.08"E
9. 38° 33' 35.86"N 27°50’ 22.54"E

were below detection limit in stations 1, 8, 10 and ranged between 0.16 to 1.2 mg/L and nitrite levels was below detection limits in stations 1, 7, 10 and it ranged between 0.005 to 0.398 mg/L.

DISCUSSION

Gediz River flows from east to west into the Aegean Sea and it is about 275 km long and drains an area of 17200 km^2 and there is 3 important branches leading into Gediz River (Figure 1). The basin is suffering from heavy pollution due to industrial zones located in the sampling area and water scarcity caused mainly by irrigation [14, 15]. Furthermore, Gediz Delta, situated on the Aegean coast of Turkey, is as an "Important Bird Area" (IBA) and it has been designated as a Ramsar site [16]. Thus, periodic research is a necessity to assess water management plans.

In this study a total of 17 stations were sampled in Gediz River Basin and a total of 22 rotifer species were identified (Table 1). The less number of species compared to other rivers in Turkey [17, 18] may be attributed to

Table 1: The list of zooplankton species and their distribution amongstations

Rotifera	Stations
Asplancha priodonta	4
Brachionus angularis	4,5
Brachionus plicatilis	5
Brachionus urceolaris	6
Colurella adriatica	4, 5, 12, 16
Colurella colurus	5, 8, 12
Filinia longiseta	3, 4
Filinia terminalis	5
Keratella cochlearis	1, 7, 8, 9
Keratella quadrata	7
Keratella tecta	1, 9, 16
Lecane bulla	15
Lecane closterocerca	11, 12
Lecane hamata	11, 12, 15, 16
Lecane luna	12
Lecane lunaris	11, 15, 16
Lepadella acuminata	4
Lepadella ovalis	6
Lepadella patella	12
Polyarthra vulgaris	4
Pompholyx sulcata	11
Synchaeta oblonga	4

Table 2: The physicochemical parameters of the sampling stations; temperature (Temp), electrical conductivity (EC), dissolved oxygen (DO), pH, total phosphorus (TP), total nitrogen (TN), nitrate (NO_3) and nitrite (NO_2)

Stations	Temp.(°C)	EC (µS/cm)	DO (mg/L)	pH	TP mg/L	TN mg/L	NO3 mg/L	NO_2µg/L
1	11.4	275	9.39	8.95	<0.005	0,73	<0,1	<0,002
2	18.1	642	8.21	8.55	<0.005	0,83	0,31	0,026
3	20.5	838	8.20	8.86	0.082	0,95	0,41	0,073
4	21.8	1041	8.31	8.55	0.072	<0,1	0,4	0,053
5	22.3	983	8.09	8.73	0.930	0,24	0,38	0,027
6	25.9	1021	9.29	8.56	0.038	1,03	0,34	0,005
7	13.8	560	5.88	8.51	0.110	6,26	0,34	<0,002
8	27.6	1594	4.99	8.34	0.929	2,4	<0,1	0,113
9	19.6	618	7.45	8.42	0.258	5,86	0,45	0,038
10	23.7	1413	1.50	8.02	2.47	18,1	<0,1	<0,002
11	25.1	2679	2.70	8.12	2.54	8,22	0,16	0,032
12	25.4	984	7.16	8.32	0.309	<0,1	0,36	0,120
13	24.2	961	1.75	8.05	1.083	10,03	0,91	0,089
14	26.2	1641	6.38	8.48	0.791	<0,1	0,59	0,126
15	23.5	823	3.62	8.31	0.564	<0,1	0,21	0,108
16	23.3	612	7.21	8.29	0.470	3,77	0,16	0,196
17	25.7	1204	8.21	8.76	0.472	2,21	1,20	0,398

the unfavorable conditions in the basin. It was found that most common rotifer species found in this study such as *Colurella adriatica, Keratella cochlearis* and *Lecane hamata* were cosmopolite in nature [19]. Species such as *Asplancha priodonta, Brachionus plicatilis, B. urceolaris, Filinia terminalis, Keratella quadrata, Lecane bulla, Lecane luna, Lepadella acuminata, Lepadella ovalis* and *Lepadella patella* were observed only in one station and no zooplankton were observed in Stations 2, 10, 13, 14 and 17 which might be the result of deteriorated water quality in those stations.

The water temperature was in the range of normal values for the season. The EC values were higher than 1000 µS/cm in Stations 4, 6, 8, 10, 11, 14 and 17 and were lowest in Station 1 with an EC value of 275 µS/cm. The pH levels were in the expected limits and considered not to be limiting factor. However, DO level was not in the normal limits necessary for biological activities in Stations 10, 11, 13 and 15.

Total phosphorus levels were below detection limit in Stations 1 and 2 and showed a gradual increase downwards the river. However a sharp increase was recorded in Station 5 where agricultural activities take place. Thus, it seems that phosphorus load may result from excessive use of fertilizers. The decrease in the total phosphorus levels in Station 7 which is located on the outlet of Demirköprü Dam Lake seems to be the result of settlement of phosphorus during hydraulic residence in the lake [20, 21]. Station 8, 10, 11 and 12 which are branches leading to Gediz River seems to carry additional phosphorus load to the river, which in turn lead to an increase in the downwards of basin. Since Station 11 is located on the outlet of the waste water treatment facility of the industrial zone (Kemalpaşa, İzmir), it is reasonable to speculate that the facility was not able to provide an effective treatment. It was found that the total nitrogen, nitrate and nitrite levels showed fluctuation among stations which could be a result of localized sewage discharge, or wash off of fertilizers from agricultural lands. The sharp increase in the total nitrogen levels in Station 13 seems to be resulting from the load carried by Stations 11 and 12 which supports our claim on the efficiency of the treatment facility. Thus, it seems that the main source of phosphorus and nitrogen load comes from the branches leading to Gediz River. Therefore, efforts designed to improve water quality should target those agricultural areas, aiming to reduce agricultural nutrient reduction which is stated as a prominent initiative for water management [22]. Since hydraulic time in streams is lower compared to lakes, instantaneous measures may lead to misinterpret the data. However, it should be kept in mind that they still carry nutrient loads to the lakes which in turn may lead to problems related to eutrophication [23].

A combination of physicochemical parameters such as light, temperature, dissolved oxygen and nutrients available, along with both inter- and intraspecies interactions [24] may affect the community structure and dynamics of zooplankton [5]. Since zooplankton is a good indicator of those changes [25] it has an important role in biomonitoring the deteriorating effects of human activities. Thus, historical data sets along with physicochemical parameters and nutrient levels are needed for understanding the actual effects over time and water management practices in water bodies. Taking the whole picture into account, it is clear that there is a gradual increase in the amount of nutrients from upper reach to downstream in the Gediz River Basin, especially in the branches leading to the river. Thus control management practices should concentrate around those sites.

ACKNOWLEDGEMENT

A part of this study was supported by the Republic of Turkey Ministry of Forestry and Water Affairs (Basin Monitoring and Determining Reference Points Project).

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