Journal of Applied Biological Sciences 8 (1): 57-63, 2014
ISSN: 1307-1130, E-ISSN: 2146-0108, www.nobel.gen.tr

The Effects of Irrigation Pumps on the Zooplankton Composition in Lake Eğirdir (Isparta/Turkey)

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Received: March 19, 2014
Accepted: April 22, 2014

Abstract

The aim of this study was to found the effects of irrigation pumps on the distribution zooplankton in the Lake Eğirdir. The abundance of zooplankton in the Lake were determined in different zones (pelagic and pump outlet) between May -September 2010 with 5 monthly periods. Zooplankton samples were taken from pelagic and pump outlet zones by using plankton net a mesh size of 55 µm. A total of 49 taxa were recorded as 31 Rotifera, 16 Cladocera and 2 Copepoda. Sørensen similarity index and indicator species analysis were used. *Testudinella patina, Euchlanis dilatata, Lecane luna, Lecane bulla, Disparalona rostrata, Nitocra hibernica, Trichotria pocillum* and *Mesocyclops leuckarti bodanicola,* which were found in the lake, are indicator species of pelagic and pump outlet zones.

Keywords: Zooplankton, pelagic zone, pump outlet zone, Lake Eğirdir, Turkey

INTRODUCTION

Zooplanktonic organisms of inland waters consist of Rotifera, Cladocera and Copepoda [1]. Zooplankton are indubitable the most important prey for larval and juvenile stages of freshwater fish [2]. The abundance and species diversity of the zooplankton is observed by several elements in fresh water. Organic substance, dissolved oxygen and water temperature are significant elements which controls the growth of zooplankton [3]. Aquatic invertebrates form e very diverse group, play an important ecological role, participate directly in the processes that maintain the aquatic ecosystem [4].

Pumping systems have to feasible impacts on fish. Firstly, fish could be directly removed from river systems depending on the size, capacity and location of the pumps, this activity could effect many different species at many different life history stages. Secondly, pumps could physically injure or kill fish during the extraction process. Besides, Baumgartner et al. [5]) studied that the effects of irrigation pumping systems on fish of the Murray-Darling Basin. And, Baumgartner et al. [5] informed that effects of irrigation pumps on riverine fish. Over 2300 fish passed through the pump outlets over the study period, with many individuals (7.5 % of total) both killed and injured.

A large number of pump stations were installed around the lake Eğirdir to be used for different purposes (drinking water, agriculture, etc.) by DSI. In addition, every year, are reportedly taken from the lake water between 700-1000 hm^3, 6 pumps for different purposes and a regulator introduced by DSI. Also, Kesici and Kesici [6] determined that 700-1000 hm^3 of water taken from the lake each year between 6 pumps for different purposes and a regulator introduced by DSI.

Within aquatic environment, the zooplankton fauna may vary greatly between the pelagic region and pump outlet region compartments. Several studies have demonstrated a higher richness in zooplankton species in littoral regions, especially when these are colonized by aquatic macrophytes [4]. This lack of studies on zooplankton organisms in (pump outlet zone) of the lakes also applies to Lake Eğirdir. Although many aspects of this lake have been studied since 1940 [7], tha majority of studies on the zooplankton community were carried out only in the pelagic zone [8-16]. Considering the pump outlet region area of Lake Eğirdir and the lack of studies on the zooplankton community in this compartment, the present study had two main objectives: i) to demonstrate the contribution of the pelagic and pump outlet zones to a better characterization of the zooplankton fauna, and ii) to asses species' distribution in different habitats (pelagic and pump outlet zones).

MATERIALS AND METHODS

Study area

Eğirdir Lake is located in southern Turkey at an elevation of 918 m above sea level. The surface area and mean depth of the lake are 47.250 ha and 7–8 m, respectively [17]. The lake serves as a municipal water source for the city of Isparta, and therefore, maintenance of good water quality is important within the lake.

Zooplankton samples were collected monthly May 2010-September 2010 from four stations selected from Lake Eğirdir in pelagic and pump outlet zones (Figure 1). Samples were taken using plankton net Hydrobios Kiel with a mesh size of 55 µm. The samples were preserved in a solution 4 % formaldehyde. The zooplankton were counted in Sedwick-Rafter chamber under invert microscope. The zooplankton organisms were identified to species level [18-23]. Water temperature, pH, dissolved oygen and conductivity were measured in the field using WTW 340i. Indicator analysis of species were assessed between pelagic and pump outlet zones by the test [24]. Sorenson similarity index was used while applying Bray-Curtis method. The analysis was performed by using PC-ORD [25]. In comparing the zooplankton composition were used the Shannon Wienner index and Pielou's evenness index in the pelagic and pump outlet zones [26, 27].

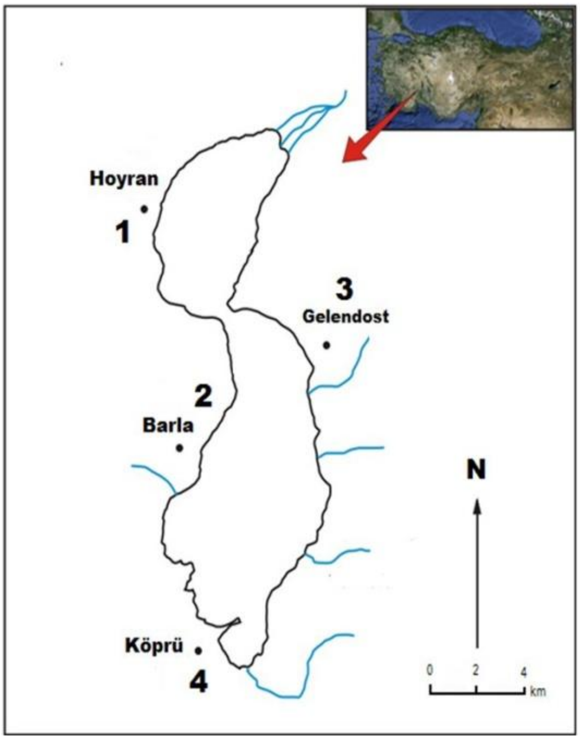

Figure1. Map of the study area

RESULTS AND DISCUSSION

The zooplankton determined belonged predominantly to the Rotifera, Cladocera and Copepoda in Eğirdir Lake. The total species were recorded from this lake during the present study, in which 63.3 % species of Rotifera, 32.7 % species of Cladocera and 4.0 % species of Copepoda contributed to zooplankton diversity in this lake. The total zooplankton population dominated by Rotifera. A list of the zooplankton organisms present in the samples is provided in Table 1. Monthly abundance of zooplankton for pelagic and pump outlet zones presented in Fig. 2-3. While Rotifera were the average number with 1.025 individuals/L during September; Copepoda showed the lowest abundance with 5 individuals/L during May in the pelagic zone.

The population abundance of Rotifera reached a maximum of 96.36 % in the pelagic zone. The lowest Rotifera was encountered during May, with a of about 128 Ind/L. The maximum population abundance of Cladocera was observed 18.57 % during August. The minimum population abundance of Cladocera was found 10 Ind/L during May in the pelagic region. The Copepoda group quantitatively comprises 4 % of the zooplankton in the pelagic zone. Within this group, the lowest abundance of Copepoda was recorded in May as 5 Ind/m^3 and the highest abundance was found in July as 10.08 %. Rotifera was in July with a maximum average of 99 Ind/L at pump region. On the other hand, Copepoda was in May with a minimum individuals (Figure 3). Rotifera was the most dominant group in pump outlet zone, making up 95.57 % of the other zooplankton groups. Abundance of Rotifera was in May with a minimum value of 2 Ind/L. Cladocera and Copepoda were the dominant groups at the pump outlet zone with value of 25.78 % and 28.73 %, respectively. Figure 4 shows the abundance (Ind/L) of zooplankton in pelagic and pump outlet zones, for samples collected during the study periods. It shows that Rotifera and Cladocera more abundance present than Copepoda at the pelagic zone of lake. In contrast to the pelagic zone, Rotifera, Cladocera and Copepoda also were low abundant at the pump outlet zone (Figure 4).

It is found that the total zooplankton abundance of Rotifera were 92.45 % and 89.60 % at pelagic and pump outlet zones, respectively. Cladocera was recorded in low abundance (2.72 %) at pump outlet zone. Although Cladocera reached a maximum at the pelagic zone (4.04 %). The maximum abundance of Copepoda was 7.68 % at the pump outlet zone (Figure 5).

According to the individuals of Rotifera was determined 9583 Ind/L in the pelagic region, and 213 Ind/L in the pump outlet region. Copepoda was found 363 Ind/L in the pelagic region, and 18 Ind/L in the pump outlet region Moreover, Cladocera showed 419 Ind/L in the pelagic region and 6 Ind/L in the pump outlet region (Figure 6). (During the study, the water was drawn a total of 26.724.771 m^3 over pump).

Table 1. Occurrence of zooplankton taxa in samples from pelagic and pump outlet zones

	Months				
ROTIFERA	**May**	**June**	**July**	**August**	**September**
Platyias quadricornis	●	●△	●	●	-
Brachionus angularis	-	●△	●△	●△	●△
Brachionus calyciflorus	△	●	-	-	-
Brachionus patulus	-	△	-	●	-
Brachionus quadridentatus	-	●	●	●	●
Keratella cochlearis	●△	●△	●△	●△	●△
Euchlanis dilatata	●	●	●	●	●
Mytilina sp.	-	-	●	●	●
Trichotria pocillum	●	-	-	●	●
Trichotria tetractis	-	●	●	●	-
Lecane flexilis	●	-	-	-	-
Lecane luna	●	●	●	●	●
Lecane bulla	●	●	●	●	●
Lecane clostrocerca	●	-	-	●	-
Lecane lunaris	-	-	-	●	-
Lecane stenroosi	-	-	●	●	●
Scaridium longicaudatum	-	●	-	●	-
Cephalodella gibba	-	-	△	-	-
Trichocerca sp.	●	-	-	-	-
Trichocerca capucina	-	●	●	△	△
Trichocerca cylindrica	-	●	-	●△	●△
Trichocerca similis	●	-	●△	●△	●△
Trichocerca bicristata	-	-	●	●	●
Ascomorpha sp.	-	-	△	●△	●
Synchaeta pectinata	△	●△	●△	●	●△
Polyarthra dolichoptera	●△	●△	●△	●△	●△
Asplanchna priodonta	●△	●△	●△	●△	●△
Testudinella patina	●	●	●	●	●
Conochilus dossuarius	-	●△	●△	●△	●△
Hexarthra mira	●	●△	●	●△	●△
Filinia longiseta	●	●△	●△	●△	●△
CLADOCERA					
Diaphanosoma lacustris	-	-	-	△	△
Daphnia cucullata	●	-	●△	●△	●
Ceriodaphnia quadrangula	-	-	●△	●△	△
Moina micrura	-	-	-	●	-
Macrothrix laticornis	-	-	-	●	-
Bosmina longirostris	●△	●△	●△	●△	●△
Pleuroxus aduncus	●	-	-	-	-
Disparalona rostrata	●	-	●	●	-
Chydorus sphaericus	●	△	●△	●	△
Alona guttata	●	-	●	-	-
Alona quadrangularis	-	●△	●	-	-
Alona rectangula	●	●	●△	△	-
Acroperus harpae	-	-	-	△	-
Graptoleberis testudinaria	●	△	●	-	-
Leydigia leydigi	-	●	-	●	-
Biapertura affinis	●	-	-	-	-
COPEPODA					
Mesocyclops leuckarti bodanicola	△	●△	●△	●△	△
Nitocra hibernica	●△	●△	●△	●	●△

△: Pelajic zone ●: Pump outlet zone ●△: Pelagic and pump outlet zones

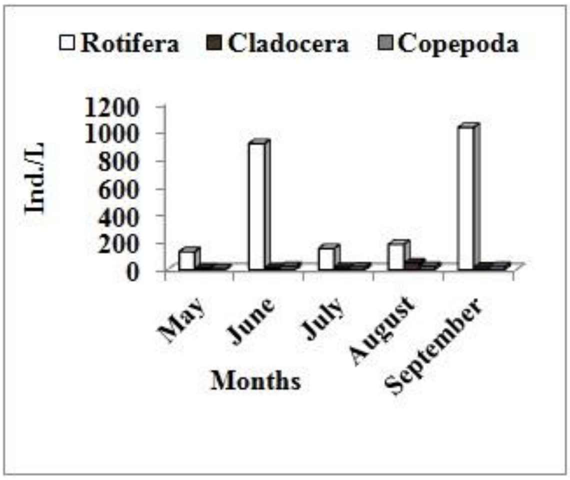

Figure 2. Average number of individuals for the zooplankton taxa in the sampling zones (pelagic zone) during the study period

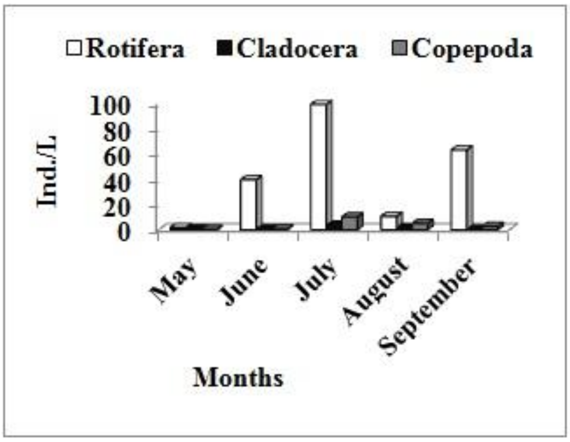

Figure 3. Average number of individuals for the zooplankton taxa in the sampling zones(pump out zone)

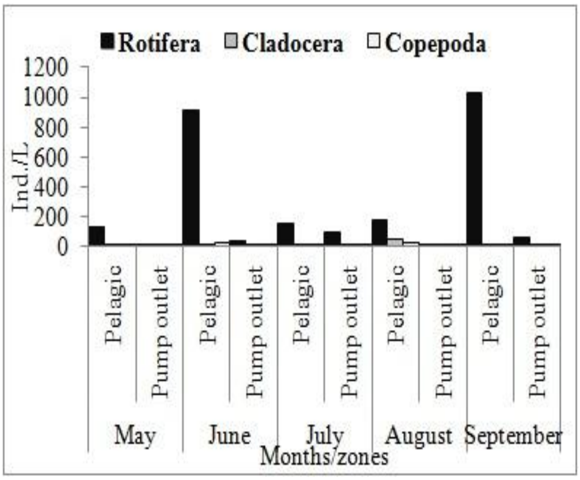

Figure 4. Average number of individuals for the zooplankton taxa in the sampling zones (pelagic and pump out zones) during the study period

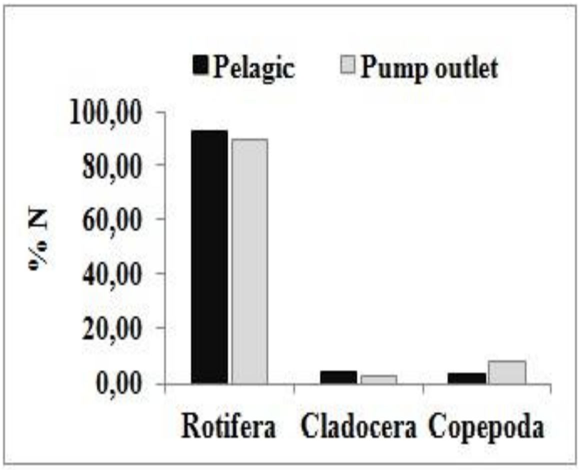

Figure 5. Composition of zooplankton in pelagic and pump outlet zone (%)

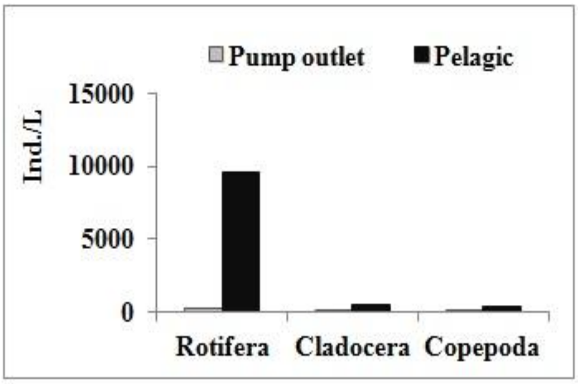

Figure 6. Composition of zooplankton as individuals in pelagic and pump outlet zone

Axis 1 and Axis 2 extracted 14.84 % and 8.99 % of the original distance matrix respectively. *P.dolichoptera*, *B.longirostris* and *M.leuckarti* bodanicola were the species that showed a positive correlation with 1st axis. Besides, *D.cucullata*, *M.leuckarti bodanicola* and *B.longirostris* specimens showed a positive correlation 2nd axis. There was no correlation in the third axis (Table 2). The pelagic and pump outlet zones of this lake did not show any statistically significant difference according to species diversity ($t= 6.698$, $p< 0.05$) (Figure 7). But, the pelagic and pump outlet zones of this lake did found statistically significant difference according to species richness ($t= 6.698$, $p< 0.05$) (Figure 8). The reason for this was related to the distribution of quantitative of the species. Because the terms of Evenness values were found statistically at the 5% level is almost no difference between the pump outlet and pelagic zone ($t=2.066$, $p< 0.05$) (Figure 9). In other words, the more species found in the pelagic zone compared with the pump outlet zone. *T. patina*, *E.dilatata*, *L.luna*, *L.bulla*, *D.rostrata*, *N.hibernica* and *T.pocillum* had the best indicator species, showing in the pelagic zone (Table 3). *M.leuckarti* was the species that found as indicator species in the pump outlet zone (Figure 10). It shows that species diversity of pump outlet zone was more density than species diversity of pelagic zone (Figure 7).

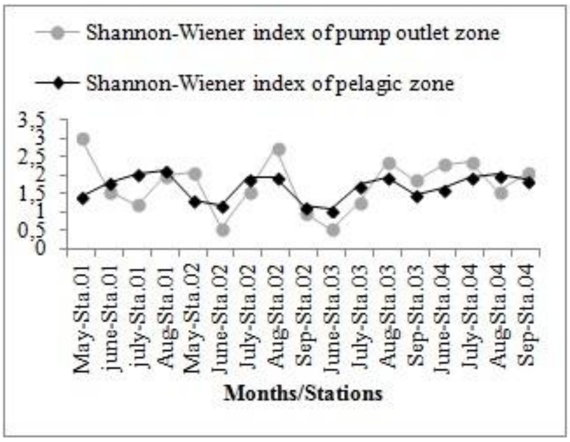

Figure 7. Species diversity of pump outlet and pelagic zones

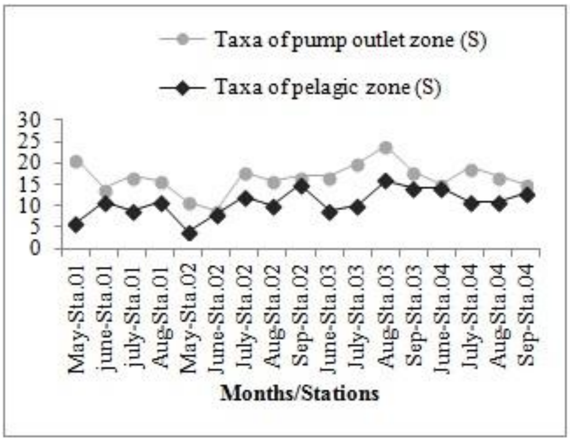

Figure 8. Species richness of pump outlet and pelagic zones

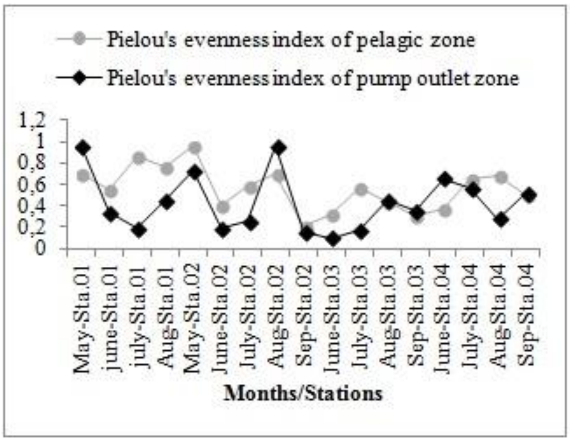

Figure 9. Pielou's evenness index for pump outlet and pelagic zones

Table 2. Pearson and Kendall Correlations with Ordination Axes

Species	Axis 1 (r)	Axis 2 (r)	Axis 3 (r)
Kelcoc	0.519	-0.025	-0.229
Asppir	0.559	0.175	-0.116
Synpec	0.542	-0.167	-0.279
Poldol	**0.707**	-0.152	-0.346
Fillon	0.512	-0.068	-0.229
Braang	0.209	0.144	-0.017
Bracal	-0.221	-0.509	-0.021
Brapatu	0.211	-0.056	-0.093
Braqaud	-0.116	-0.170	0.004
Hexmir	0.372	0.068	-0.130
Ascomo	0.115	0.297	0.131
Condos	0.262	0.093	0.034
Trisim	0.389	0.211	-0.040
Tricylin	0.479	-0.071	-0.251
Tric.sp	-0.268	-0.278	-0.262
Tribic	-0.039	-0.009	0.127
Tricap	0.492	-0.057	-0.252
Tricpoc	-0.516	-0.263	-0.408
Trictet	-0.122	-0.117	0.133
Tespat	-0.218	-0.071	0.238
Eucdila	-0.521	-0.278	-0.125
Leclun	-0.303	-0.139	-0.047
Lecbul	-0.445	-0.353	0.040
Lecflexi	-0.268	-0.278	-0.262
Lecclost	-0.445	-0.289	-0.567
Lecsten	-0.077	-0.007	0.191
Leclunar	-0.205	-0.076	-0.019
Mytilina	-0.397	-0.229	-0.105
Platquad	0.200	-0.065	-0.091
Scarlong	-0.415	-0.417	-0.044
Cepgib	0.047	0.166	0.060
Boslon	**0.716**	**0.537**	-0.083
Aloquad	0.285	-0.055	-0.096
Correc	0.006	0.222	0.258
Alogut	-0.241	-0.306	-0.148
Pleadun	-0.268	-0.278	-0.262
Dapcuc	0.018	**0.507**	-0.002
Chyspha	0.129	0.099	0.056
Biaperaf	-0.268	-0.278	-0.262
Graptes	0.207	-0.056	-0.102
Disros	-0.511	-0.290	-0.218
Moimicru	-0.077	-0.009	0.003
Ceriquad	0.130	0.177	0.055
Macrolat	-0.432	-0.152	-0.240
Leyleyd	-0.477	-0.459	-0.196
Dialac	0.256	0.392	-0.110
Acrohar	0.002	0.281	0.150
Nithib	0.415	0.023	-0.164
Mesoleuc	0.633	**0.576**	-0.050

Table 3. Results of indicator species analysis

Species	Max grup	Indicator Value (IV)	Mean	S.Dev	p *
Kelcoc	2	51.5	51.5	1.63	1.0000
Asppir	2	49.0	45.7	4.61	0.3800
Synpec	1	32.7	33.5	6.61	0.7060
Poldol	2	53.1	49.9	3.42	0.4740
Fillon	1	32.7	33.6	6.45	0.7170
Braang	1	35.6	36.4	5.99	0.7380
Bracal	1	5.9	5.9	0.19	1.0000
Brapatu	1	2.9	7.2	4.42	1.0000
Braqaud	1	23.5	11.3	5.42	0.1050
Hexmir	1	17.6	24.9	6.66	1.0000
Ascomo	1	26.2	24.0	6.07	0.4820
Condos	1	17.6	25.1	6.70	1.0000
Trisim	1	28.0	32.7	6.23	1.0000
Tricylin	2	22.2	26.6	5.76	1.0000
Tric.sp	1	5.9	5.9	0.19	1.0000
Tribic	1	23.5	11.1	5.07	0.0810
Tricap	2	15.7	14.8	5.67	0.6400
Tricpoc	**1**	**29.4**	**14.0**	**5.02**	**0.0440**
Trictet	**1**	**17.6**	**10.3**	**4.28**	**0.2540**
Tespat	**1**	**58.8**	**21.8**	**6.54**	**0.0010**
Eucdila	**1**	**76.5**	**27.0**	**6.41**	**0.0010**
Leclun	**1**	**52.9**	**20.8**	**5.98**	**0.0020**
Lecbul	**1**	**70.6**	**24.8**	**6.53**	**0.0010**
Lecflexi	1	5.9	5.9	0.19	1.0000
Lecclost	1	17.6	10.3	4.25	0.2490
Lecsten	1	17.6	10.2	4.21	0.2420
Leclunar	1	5.9	5.9	0.19	1.0000
Mytilina	**1**	**29.4**	**13.8**	**5.01**	**0.0450**
Platquad	1	18.8	14.0	5.10	0.3550
Scarlong	1	17.6	10.1	4.11	0.2270
Cepgib	2	5.9	5.9	0.19	1.0000
Boslon	1	50.0	50.0	1.58	1.0000
Aloquad	1	5.9	11.2	5.39	1.0000
Correc	1	10.6	13.9	5.20	1.0000
Alogut	1	17.6	10.1	4.16	0.2350
Pleadun	1	5.9	5.9	0.19	1.0000
Dapcuc	1	24.0	25.0	6.81	0.7210
Chyspha	1	21.0	17.4	5.52	0.4120
Biaperaf	1	5.9	5.9	0.19	1.0000
Graptes	1	7.8	10.1	4.13	1.0000
Disros	**1**	**29.4**	**13.7**	**4.86**	**0.0390**
Moimicru	1	5.9	5.9	0.19	1.0000
Ceriquad	1	5.9	11.5	5.46	1.0000
Macrolat	1	5.9	5.9	0.19	1.0000
Leyleyd	1	11.8	7.1	4.41	0.4750
Dialac	2	23.5	11.2	5.35	0.0980
Acrohar	2	5.9	5.9	0.19	1.0000
Nithib	**1**	**63.0**	**38.2**	**5.58**	**0.0040**
Mesoleuc	**2**	**62.7**	**42.0**	**5.90**	**0.0060**

1: Pump outlet zone 2: Pelagic zone

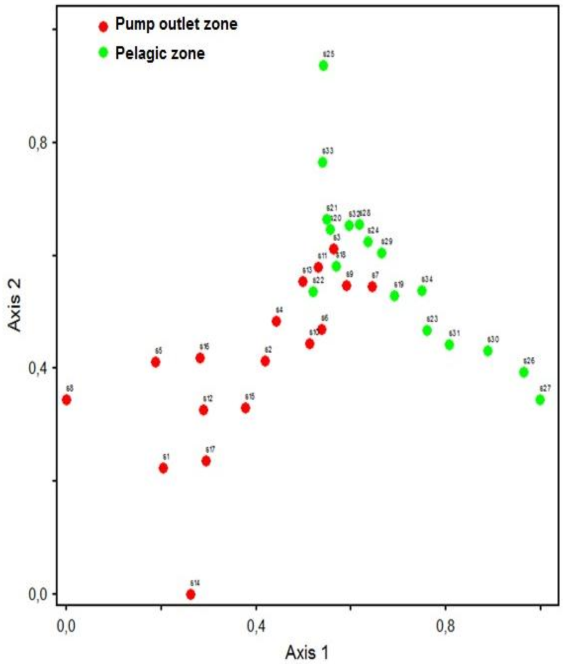

Figure 10. The spatial distributions of species in the study area (s1-s17: pump outlet zone; s18-s34: pelagic zone)

They were found that the littoral zone plays a significant role for a better characterization and conservation of the zooplankton fauna in tropical lake [4]. In this study, the highest number of species was obtained in the sample from pump outlet zone (46 species) and the lower number was found in the pelagic zone (27 species) (Table 1). Zooplankton are found to similar qaulitative in pump outlet and pelagic region. In addition to the high abundance of Copepoda by percantege, this consideration is based on the highly abundance of these Copepoda and their only increased small forms. The number of individuals of Rotifera, Cladocera and Copepoda were also found between pump outlet and pelagic region to be significant different as observed in the study (Total zooplankton of pelagic region with 10365 Ind/L and total zooplankton of pump outlet region with 238 Ind/L). Baumgartner et al. [5] observed quantify the composition and number, of fish removed from main river channels via pumping systems and investigated any changes over the diel period in Murray-Darring Basin. In addition, they are reported that the degree of fish injury, mortality and the relative physical impacts of the pumping process [5]. In general, we observed in zooplankton that the individuals of species in pelagic region are more extensive than for pump outlet region. Zooplankton in pumps showed in this lake, and did draw together with irrigation water. But, the proprotion of those taken zooplankton could not affect ecological level in lake Eğirdir.

Acknowledgements

We would like to express our deep thanks to all members of the project team for their kind help during this study from the Fisheries Research Station.

REFERENCES

[1] Tanyolaç J. 2009. Limnoloji (Tatlı Su Bilimi) 5. Baskı. Hatiboğlu Basım ve Yayım San. Tic. Ltd. Ankara, 294p.

[2] Wedderburn S, Shiel R, Hillyard K, Brookes J. 2000. Zooplankton response to watering of an off-channel site at the lower Lakes and implications for Murray hardyhead recruitment. The University of Adelaide, Adelaide, 52p.

[3] Jadhav S, Borde S, Jadhav D, Humbe A. 2012. Seasonal Variations of zooplankton community in Sina Kolegoan Dam Osmanabad district, Maharashtra, India. *Journal of Experimental Sciences*. 3 (5), 19-22.

[4] Maia-Barbosa PM, Peixoto RS, Guimarães AS. 2008. Zooplankton in Littoral waters of a Tropical Lake: A Revisited Biodiversity. *Brazilian Journal of Biology.* 68 (4, Suppl.), 1069-1078.

[5] Baumgartner L, Reynoldson N, Cameron L, Stanger J. 2007. The effects of selected irrigation practices on fish of the Murray-Darling Basin. NSW Department of Primary Industries-Fisheries Final Report Series, 92.

[6] Kesici E, Kesici C. 2006. The Effects of Interverences in Natural Structure of Lake Eğirdir (Isparta) to Ecological Disposition of the Lake. E.U. *Journal of Fisheries & Aquatic Sciences*. 23 (1/1), 99-103.

[7] Mann AK. 1940. Über pelagische copepoden Turkischer Seen. Int. Revue der Gesam. *Hydrobiol*ogy. 40, 1-87.

[8] Kiefer F. 1952. Freilebende ruderfusskrebse (crustacea, copepoda) aus türkischen binnengewassern. I Calanoida. İ.Ü.F.F. *Hidrobiyoloji Araştırma Enstitüsü Yayınları*. 1 (2), 103-132.

[9] Kiefer F. 1955. Freilebende ruderfusskrebse (crustacea, copepoda) aus türkischen binnengewassern, Cyclopoida und harpacticoida. İ.Ü.F.F. *Hidrobiyoloji Araştırma Enstitüsü Yayınları*. 2 (4), 108-132.

[10] Numann W. 1958. Anadolunun Muhtelif Göllerinde Limnolojik ve Balıkçılık İlmi Bakımından Araştırmalar ve Bu Göllerde Yaşayan Sazanlar Hakkında Özel Bir Etüd. *İstanbul Üniversitesi Fen Fakültesi Hidrobiyoloji Araştırma Enstitüsü Yayınlarından*. 7, 114p.

[11] Emir N. 1991. Some rotifers from Turkey. *Doğa Turkish Journal of Zoology*. 15, 39-45.

[12] Gündüz E. 1997. A Checklist of cladoceran species (crustacea) living in Turkish inland waters. *Turkish Journal of Zoology*. 21, 37-45.

[13] Kazancı N, Girgin S, Dügel M, Oğuzkurt D, Mutlu B, Dere Ş, Barlas M, Özçelik M. 1999. Köyceğiz, Beyşehir, Eğirdir, Akşehir, Eber, Çorak, Kovada Yarışlı, Bafa, Salda, Karataş, Çavuşçu Gölleri, Küçük ve Büyük Menderes Deltası, Güllük Sazlığı, and Karamuk Bataklığının Limnolojisi, Çevre Kalitesi ve Biyolojik Çeşitliliği, *Türkiye İç Suları Araştırmaları Dizisi*. Ankara, Türkiye, IV: 371p.

[14] Kaya M, Altındağ A. 2007a. Some cladoceran species from Turkish inland waters. *SDÜ Fen Edebiyat Dergisi.* 2 (1), 60-76.

[15] Kaya M, Altındağ A. 2007b. Brachionidae (rotifera: monogononta) species from Turkey. *Asian Journal of Animal Sciences*. 1-6.

[16] Didinen H, Boyacı YÖ. 2007. Determination on base systematic and ecology of rotifer fauna (rotifera) in hoyran region of Eğirdir Lake. *E.U. Journal of Fisheries & Aquatic Sciences*. 24 (1-2), 31-37.

[17] Yarar M, Magnin G. 1997. Türkiyenin Önemli Kuş Alanları. *Doğal Hayatı Koruma Derneği*. Türkiye, 313p.

[18] Dussart, B., 1967. Les copepodes des eaux continentales d'europe occidentale, tome i, calanoides et harpacticoides, N. Boubee et cie, Paris, 500p.

[19] Dussart B. 1969. Les copepodes des eaux continentales d'europe occidentale, tome ii, cyclopoides et biologie, N Boubee et cie, Paris, 292p.

[20] Koste W. 1978. Rotatoria, Die Rädertiere Mitteleuropas Ein Bestimmungswerk, Begründet von Max Voigt Überordnung Monogononta. I Textband. Gebrüder Borntraeger, Berlin, Stuttgart. 672p and II Textband, 234p.

[21] Negrea S. 1983. Fauna Republici Socialiste Romania. Crustacea, Cladocera. 4, 12, Acedemia Rep. Soc. Romania, Bucuresti, 367p.

[22] Korovchinsky NM. 1992. Sididae and holopedidae (crustacea: daphniiformes), guides to identification of the microinvertebrates of the continental waters of the world, SPB Academic Pub., The Netherlands, 82p.

[23] Ustaoğlu MR. 2004. A Check-list for zooplankton of Turkish inland waters. *Ege Univ J Fish Aquat Sci.* 21, 191-199.

[24] Dufrene M, Legendre P. 1997. Species Assemblages and Indicator Species: The Need for a Flexible Asymmetrical Approach. *Ecological Monographs*. 67, 345-366.

[25] Bray JR, Curtis JT. 1975 An Ordination of Upland Forest Communities of Southern Wisconsin. *Ecological Monographs*. 27, 325-349.

[26] Carlo HRH, Peter MJ, Soetaert HK.1998. Indices of Diversity and Evenness. *Océanis*. 24 (4), 61-87.

[27] Özkan K. 2012. Comparison of Taxonomic Diversity Indices with Traditional Diversity Indices. *SDU Faculty of Forestry Journal*. 13, 107-112.