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Identifying the Benthic Organisms Diversity in Shahrechay River and Dam Lake, Western Azerbaijan Province, Iran

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ABSRACT Shahrechay Dam is located at 12th Km of Shahrechay River in Urmia. This study was conducted for a year (Spring to fall, 2007) to identify different species of benthic organisms in the dam. Considering the relevant topographic status like the local depth and water speed, 6 sampling stations were chosen and sampling was done in shallow locations of the river by means of superficial method. In this study, 2 phylums, 2 orders, 13 families and 21 species of benthic organisms were identified in Shahrechay Dam Lake. The results indicated that the highest species diversity belonged to Ecdyonuridae family (*Eperous* Genus). In terms of frequency, it belonged to Tibuficidae (*Tubifex* Genus), with 43%, 23%, and 11% ratios for spring, summer, and fall, respectively. The final result of the research demonstrated the poverty of lake bed from view of the benthic quantity and density. Therefore, the Shahrechay Dam was not a suitable candidate to develop fishery's purposes, especially releasing and growing Cyprinidae fishes and other benthos-feeder aquatics.

Key words: *Benthic organisms, Chironomidae, Epeorus, Shahrechay dam, Tubifex*

1 INTRODUCTION

The benthic organisms as important biological elements of the aquatic environments, play an important role in the aquatic food chains and feeding other aquatics, especially fishes (Soufiani and Naderi, 2000). In this regard, Fazli (2011) just focused on the fishes in the marine ecosystems. He evaluated changes in species composition, catch, and CPUE of three species of kilkas in the Caspian Sea from 1961 to 2009.

The benthic organisms are washed away if being exposed to the water flow. Due to the water speed and their small bodies, the benthic of the River (Randall, 2012). Therefore, these organisms shall live in the dead waters areas, e.g., certain surfaces of rocks/stones backing to the water flow and/or in the living region of the bed. These organisms are considered as the indicators of qualitative and quantitative status changes of the River throughout time (Heink and Kowarik, 2010). They vary in terms of resistance against contamination intensity and oxygen decrease, while such difference was more significant concerning some of these species, in a way that some of these species may survive in completely clean waters free from any type of contaminations, while some others may survive in highly-polluted waters (Jadin, 1996). In addition to the importance of these organisms in terms of identifying the contamination level of the water,

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studying them and determining their living cycles and density may be seen as important in assessing the potential capability of any water source for aquatic husbandry (Gray and Mirza, 1979). So, this study was conducted to determine the productivity, quantity and biodiversity of Shahrechay reservoir's benthic organisms.

2 MATERIALS AND METHODS

The Shahrechay River drains into the Dam downstream, where has a rich ecosystem. Shahrechay River originates from Zagros Mountains in northwestern Urmia and from Iran-Turkey Border. It passes through the southern parts of Urmia City and finally reaches Urmia Lake. The watershed of the Shahrechay River is divided into three main parts. Primarily the Dam Reservoir is located. In the following a river flows towards the downstream of the Dam up to Urmia Lake, that considered as the middle part. So that the river fails into the Dam downstream, where has a rich ecosystem (Asadpour *et al*., 2005; Kouhpeima and Feiznia, 2013).

Considering the topographic status of Shahrechay Lake, six sampling stations were determined by GPS and according to the regional topographic status. These stations are from the Dam margin up to the Shahrechay River into the lake in ascending order (Figure 1). In order to sample benthic organisms, the standard approach (Moog, 2005) was applied. In shallow locations, the Surber sampler is used with square superficial method to sample for a depth exceeding 10 cm with an area of 500 cm^2, while in deeper areas, sampling was conducted by using double-based dredging machine (Model: Ekmann) with an area of 25 cm^2. After this step, the samples were fixed in formalin 4% (Ghane *et al*., 2006) and transferred to State Artemia Research Center. Further identification of them was arrayed on using identification keys such as Kasymov, (2000). Sampling was done monthly, with three repetitions during 2007 year. The collected samples based on Kasymov, (2000) method are passed through fine sieves so that after being separated from sediments and washed, the existing benthic organisms observed and identified up to the level of species through being painted by using Rose Bengal (density: 1 gr l^{-1}) (Ahmadi and Nafisi, 2001).

Figure 1 General view of Shahrechay River and Dam Lake and sampling stations

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3 RESULTS AND DISCUSION

The 2 phylums, 2 orders, 13 families and 21 species of benthic organisms were identified as presented in Table 1. The results indicated that the highest species number belongs to Ecdyonuridae family (*Eperous* genus), while in terms of frequency it belongs to Tibuficidae (*Tubifex* genus), with 43, 23, and 11% ratios for spring (Figure 2), summer (Figure 3), and fall (Figure 4), respectively.

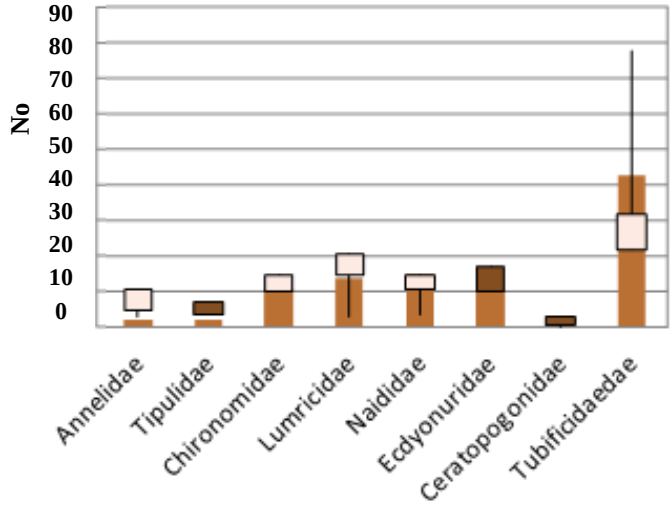

Figure 2 Number and type of benthic organisms identified in Shahrechay Dam Lake in spring 2007

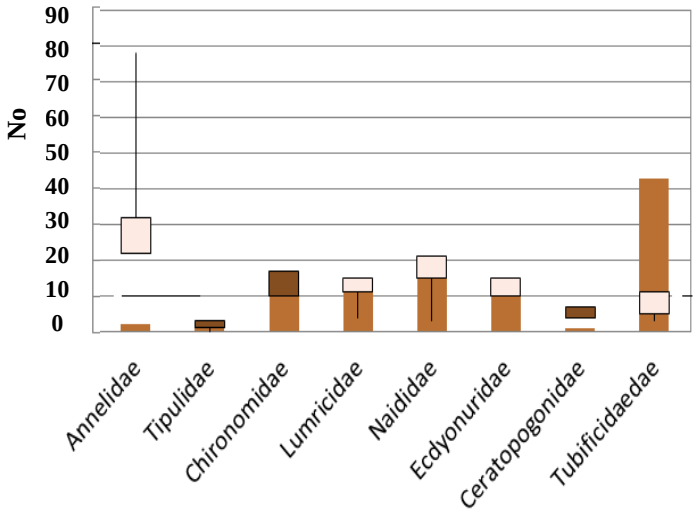

Figure 3 Number and type of benthic organisms identified in Shahrechay Dam Lake, in summer 2007

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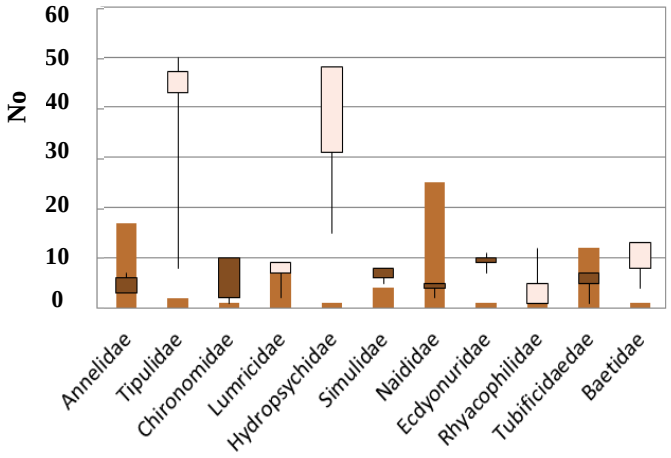

Figure 4 Number and type of benthic organisms identified in Shahrechay Dam Lake, in fall 2007

The results indicated that the highest species diversity belongs to Ecdyonuridae family including the following species: *Ecdyonurus venosus* ،*Ecdyonurus tarrertis*, *Rhithrogera semicolorata*, *Ecdyonurus venosus*, *Ecdyonurus tarrertis*, *Hepatagenia lateralis*, *Hepatogenia sulphurea* and *Epeorus* sp (Table 1). Three species are from Baetidae family (including *Baetis rhodani*, *Baetis muticus*, *Centroptilum luteolum*) and Hydropsychidae and three are related to Hydropsychidae family (*Hydropsyche instabilis*, *Hepatagenia lateralis* and *Hepatogenia sulphurea*) (Table 1).

Their frequencies (in percentage) have been given in Figures 2, 3 and 4 for different seasons of the study year. Other benthic organisms in the specified stations (stations 1 to 6) in Shahrechay Dam Lake were obtained for spring, summer and fall seasons as per Figures 2 and 3 Based on the obtained results, 2 phylums, 2 orders, 13 families and 21 species were identified from the benthic organisms mentioned in Table 1. The results indicated that the highest species diversity belongs to Ecdyonuridae family (*Eperous* genus), while in terms of frequency it belongs to Tibuficidae (*Tubifex* genus) (Table 1), with 43, 23 and 11% ratios for spring, summer, and fall, (Figures 2 to 4), respectively. Percentage and diversity of other families in different seasons also differed. With respect to the mountainous positions of the Dam and River ending to it, they had less diversity and dispersion of benthic organisms, and the lake's natural products were less in terms of the same. During spring and summer, Baetidae (of insects' sub-phylum) enjoyed high diversity and dispersion (*Baetis Centroptilum*).

In summer, due to existence of certain benthic organisms such as Chironomidae family and *Tubifex* and *Baetis* genuses indicated the existence of regional contaminations and reaching the beta-meso-sa-probe and alpha-sa- probe regions (Figure 3). The most abundant species included *Tubifex, Nais, imulium, Bezzia, Lumbric, Baetis, Centroptilum and Eperous*, all of which were from insects, oligochats and arthropoda phyla and of Trichoptera, Annelida, Ephemeroptera and Diptera orders.

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Table 1 Different Types of Benthic Organisms identified in Shahrechay River and Dam Lake, Urmia

Species	Family	Order	Sub-Phylum	Phylum
Epeorus sp. *Ecdyonurus venosus* *Ecdyonurus tarrertis* *Ecdyonurus venosus* *Ecdyonurus tarrertis* *Hepatagenia lateralis* *Heptagenia sulphurea* *Rhithrogena semicolorata*	Ecdyonuridae	Ephemeroptera	Insects	Arthoropoda
Hydropsyche instabilis *Hepatagenia lateralis* *Heptagenia sulphurea*	Hydropsychidae	Trichoptera	Insects	Arthropoda
Tipula sp.	Tipulidae	Trichoptera	Insects	Arthropoda
Simulium sp.	Simulidae	Trichoptera	Insects	Arthropoda
Bezzia sp.	Ceratopogonidae	Trichoptera	Insects	Arthropoda
Tubifex sp.	Tubificidae	Trichoptera	Oligochaeta	Annelida
Nais sp.	Naididae	Trichoptera	Oligochaeta	Annelida
Lumbric sp.	Lumbricidae	Trichoptera	Oligochaeta	Annelida
Hirudineussp.	Annelidae	Annelida	Hirudinea	Annelida
Baetis muticus *Baetis rhodani* *Centroptilum luteolum*	Baetidae	Ephemeroptera	Insects	Arthropoda
Rhyacophila dorsalis *Rhyacophila dorsalis*	Rhyacophilidae	Trichoptera	Insects	Arthropoda
Simulium sp.	Simulidae	Trichoptera	Insects	Arthropoda
Spaniotoma sp. *Chironomus sp.*	Chironomidae	Trichoptera	Insects	Arthropoda

The range of benthic organisms was studied in White River up to the family level. These organisms' classification was seen to be with the relevant load of pollution and adaptability under different River conditions in the beds as an indicator for the range of rivers contaminations (Voelker and Renn, 2000). This study was in compliance with studies resulted from Shahrechay Dam, Urmia, completely.

The species-diversity in the warmer seasons was more than those of the cold seasons which suggested that in terms of diversity, most of the samples found in spring (Figure 2) belonged to insects and the water in station No. 6 near to Shahrechay River bore, it enjoyed relatively low contamination. On the other hand, the benthic organisms existing in station No. 6 showed the bio-indictor for meso-sa-probe regions, where they live in flowing waters with relatively rocky beds while these were in compliance with results of Ahmadi and Nafisi, (2001) on identifying the flowing waters invertebrates. Studying the percentage and diversity of benthic organisms obtained in Shahrechay Dam Lake in summer season (Chironomidae) showed that the benthic organisms existing in the station No. 4 are the indicator for the alpha-meso-sa-probe waters (relatively polluted). Macro-benthic organisms live on or inside the sediments and been

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directly exposed to the pollutants aggregated on the sediments and due to their lifestyle, they are not able to escape the improper environmental conditions (Giere, 2013). The relationship between the macro-benthic organisms and effects of contaminations on these organisms has been expressed in several studies (Venturini, *et al.*, 2004; Vinagre, *et al*., 2008; Kalbassi *et al*., 2013).

Today, the interest and necessity for presenting certain techniques able to assess the changes in the aquatic environments have increased and several ecologic and biologic indicators are applied to identify the different levels of ecologic quality (Niemi and McDonald, 2004; Ajorlo and Ramdzani, 2014). Macro-benthic organisms are from the most important organisms applied to assess the health of the ecosystems (Sumaila *et al*., 2000). Due to stagnation and relatively long life cycle, these organisms are suitable indicators for environmental assessments. Environmental factors and their seasonal fluctuations are from the most important factors which may affect on aquatic organism (Le Moullac and Haffner, 2000), in a way that the benthic combination and structure change may be due to the changes in temperature, and sediments texture (Bulling *et al.*, 2010).

The benthic organisms in station No. 5 were the ecosystem indicator for the beta-meso-sa-probic species (Dolgonosov and Moiseenko, 2005). Therefore, it may be stated that station No. 5's water had a relatively lower contamination level in comparison to station No. 4 and observation of the benthic organisms in station No. 6 (Figure 1) and studying the river and reservoir of the Shahrechay Dam ecosystem features indicated the average water contamination (beta-meso-sa-probe) in this region. Studying the results from Shahrechay Lake upstream river during spring and summer showed the potential of the river environment for the living of various types of benthic organisms (Figures 2 and 3), while the identified benthic organisms indicated the environmental features in flowing waters with relatively rocky beds and low and average contaminations.

The most important Shahrechay River and Dam pollutant resources include villages, public places, recreational and villa areas, farmlands and domestic and immigrants livestock. However, the low diversity of benthic organisms indicated the relative poverty of foodstuffs in the lake (oligotrophic). In this season, in the stations besides the bore of Shahrechay River (from station 6 above), exist benthic organisms indicated that the shores of rivers and streams were muddy and the aquatic ecosystems were relatively rich of organic materials (Wetzel, 2001).

According to the Kerekes (1994) and Sifa (1979) categorizations, Shahrechay Lake water, may be considered as one of the eutrophic lakes. The final result of the study demonstrated the lake's bed poverty according to the benthic quantity and diversity which may be the result of a set of reasons, including but not limited to, short history of water depth and impenetrability of the deep lake layers against sunlight, relative low temperature in the region and lack of affecting the organic-rich flow rate of waters entering the lake. It is possible that though time and providing sufficient time to increase the production of primary food sources in the lake, and/or through applying the needed managements such as multiplication and releasing some of the invertebrates and benthic organisms, the conditions for the growth in the population of fishes in the future would be improved. Different types of benthic organisms in the various types of rivers, inter alia, water volume, river width, fauna and flora of the region, river bed coverage; mountainous streams and extensive algae areas of the same have been formed through time (Majnounian, 1999).

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The result of this study also complied with the research reports obtained from the studies of Gray *et al*., (1992), conducted on identifying the exclusive features of domestic waters' invertebrates

4 CONCLUSION

Designing a continuous monitoring plan, collecting and completing data and information obtained periodically in this regard, are from amongst the recommendable requirements. Considering the mountainous positions of the Dam and River ending to it, it affected less diversity and dispersion of benthic organisms..

5 ACKNOWLEDGMENT

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شناسایی تنوع کفزیان در رودخانه و دریاچه سد شهرچای استان آذربایجان غربی، ایران

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چکیده سد شهرچای در ۱۲ کیلومتری رودخانه شهرچای شهرستان ارومیه احداث شده است. در این پژوهش به‌مدت یک سال (بهار تا پاییز سال ۱۳۸۶) برای توسعه اهداف شیلاتی اقدام به شناسایی انواع کفزیان این سد شد. با توجه به وضعیت توپوگرافی آن، شش ایستگاه نمونه‌برداری انتخاب و نمونه‌برداری در نقاط کم‌عمق رودخانه با روش سطحی مربع شکل انجام شد. در این مطالعه تعداد ۲ شاخه، ۲ راسته، ۱۳خانواده و ۲۱ گونه از انواع کفزیان شناسایی شد. نتایج نشان داد که بیش‌ترین تنوع گونه‌ای به تعداد ۱۱ مورد متعلق به خانواده Ecdyonuridae جنس *Epeorus* بود. همین‌طور بالاترین فراوانی متعلق به خانواده Tubificidae جنس *Tubifex* با نسبت‌های فراوانی ۴۳، ۲۳ و ۱۱ درصد به‌ترتیب در فصول بهار، تابستان و پاییز است. نتیجه نهایی پژوهش بیان‌گر فقیر بودن بستر دریاچه، از نظر میزان و تنوع کفزیان و نامناسب بودن آن برای توسعه اهداف شیلاتی بالاخص رهاسازی و پرورش کپور ماهیان و سایر آبزیان با جیره غذائی بنتوزخوار است.

کلمات کلیدی: *Chironomidae* ، *Epeorus*، *Tubifex*، سد شهرچای، کفزیان

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