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Biodiversity of Tubificidae in Rumaitha River-Iraq

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Abstract

Background: The family Tubificidae (Annelida) is characterized by a special interest in studies of the pollution of the aquatic environment, which includes most species, the most common of which is the tubifex species

Aim: The physicochemical parameters, density, distribution, biodiversity of Tubificidae (Oligochaeta), and ecological aspects of Rumaitha river, South of Iraq were investigated from March 2017 to February 2017.

Material and Methods: Samples of water and Tubificidae were collected from three different stations S1, S2, S3.

Results: The results were revealed that the values water temperatures 11- 32 ^{o}C. The pH was ranged 7.1-8,1 it showed a slightly alkaline trend. The lowest value of Electrical conductivity 0.95 ms, Salinity values were ranged between 0.60 -1.7 ‰. Dissolved oxygen was ranged 5.6-11.2 mg/l. the highest value of BOD was 5 mg/l recorded in station S2, and the organic content of the bottom sediments was, 20.2% in S3 during the study period. The Tubificidae family have identified nine species belonging to five genera namely *Aulodrilus (1, Species), Branchuira, (1, Species), Limnodrilus (4, Species), profundicola, (1, Species), Tubbier (1, Species*). species distribution varied from station to station, they were 8, 5 and 7 recorded in stations S1, S2, S3 respectively. in the station S1, which is located above the city and far from the sources of pollution recorded all the species diagnosed in the current study *Aulodrilus plurisseta, Branchuira Sowerby , Limnodrilus claparedianus , L. hoffmeisteri, L. undekemianus, Potamothrix hammoniensis, Tubifex ignotus, and T. tubifex,* but did not register the species *L. profundicola* .while recorded only 5,7 species in the station S2,S3 Respectively. Quarterly fluctuations in densities of Tubificidae species were the average annual density of the worms were, 99, 72, and 84 indv/m^2 recorded at study station S1, S2 and S3 respectively, the highest annual percentage density within Tubificidae species was 31% recorded for L. Hoffmeister species. The density of Tubificidae between stations during the study showed a significant difference ($p<0.05$) between months in the density of all station in the study period. A significant correlation between the total number of individuals and some environmental measurements such as water temperature, dissolved oxygen, pH, salinity and the organic content of bottom sediments.

Sorensen Similarity was used to determine the similarity between stations taxa composition,

It was observed that the highest value was 80% between stations S1 and S2 by scale Sorensen Similarity. Results of the indicator Species deficit indicated the lowest value of the qualitative deficit 12.5 between stationS1 and station S3. This indicates that both station environment is suitable for the availability of more species than stations S2.

Conclusion: In the current study, the lowest value of biodiversity was recorded 0.26 at the station S2 in July 2017, while the highest value was 0.37 at stations S1, S3. Biodiversity was in low value and less than 1 at all stations.

Keyword: Tubificidae , Invertebrate, Oligochaete, Rumaitha River

INTRODUCTION

The family Tubificidae (Annelida) is characterized by a special interest in studies of the pollution of the aquatic environment, which includes most species, the most common of which is the tubifex species. Most members of this family have the ability to live in polluted water environments [1]. Bottom Tubificidae is of great importance in maintaining an ecological balance between bottom sediment and water column and organic matter consumption in the bottom sediment, which is a good lunch for fish, water birds and other organisms [2,3]. The importance of the Tubificidae family as indicators of environmental pollution in field studies. Some researchers have found that these worms provide a high-density guide to pollution of river water. The density of a few helminths was adopted as life guides to organic pollution [4]. Tubificid worm's counts are traditionally important in the evaluation of pollution status and water quality studies [5]. The importance of bottom invertebrates as being used as life-guides in determining water quality and suitability for human use [6]. Tubificidae worms are characterized by good resistance to agricultural pesticides used in the field [7]. Prygiel et al. (2000) noted that research in developed countries has completed integrated models of rivers and lakes, enabling them to organize, invest and protect them from pollution [8], and despite the existence of much scientific research there is no comprehensive research model for studying the biodiversity of invertebrates. A number of other researchers have used some of the life indicators of pollution, which depend on species of bottom fossils, such as ringworms, which are small, and have observed the ability of worms of the Tubificidae family to live in environments and under the river Matt [5,9] where Ibrahim, 2005 studied the biological diversity of invertebrates, including the Tubificidae family in the Daghara river and the Diwaniyah river, and confirmed that they were highly abundant. Although the scientific and environmental importance of the Albibipidaye of the family of the Olejuktit is not highlighted in this area through the study of this study to examine the quagmire of the Rumaitha River and the types of upside in this river. However, these worms capture clear global attention. Documented in many of the literature currently available, However, [1, 10-18]. Rumaitha river is the main source of drinking water, fishing, agriculture, and other human activities, and due to the scarcity of previous studies on the water quality and the biodiversity of fresh aquatic Tubificidae in the Rumaitha River,the present study aims to: study monthly changes in the physicochemical factors, the qualitative and quantitative (including diversity, similarity) of Tubificidae in the Rumaitha River, assess the correlations between physicochemical characteristics and Tubificidae in order to relate them with Tubificidae abundance and biodiversity and as a database for future research which Topics covered with the study of the aquatic environment and biodiversity of freshwater Tubificidae in the study area. This study could be the first of its kind in a study because it serves as a database for those who care about environmental studies and find out Tubificidae diversity in Rumaitha River.

MATERIALS AND METHODS

2. 1 Description of Study Area

The current study was elected three stations S1, S2, S3 on Rumaitha River. The River runs between the latitudes 31.65-31.47 north and between longitudes 45.03-45.28 eastward. Passing the district of Rumaitha, with a long of 43 km all inside the administrative borders of Al-Muthanna province. The water level in the river generally be under the natural ground level, the areas surrounding the river are primarily agricultural areas. The first study station S1 is located to the north of Rumatha spend at Kilometer 1 in the entering of the river to the district of Rumatha and surrounded the station farmland. The second station S2 is located on Rumaitha River about 1km dawn of the district center

the presence of communities on both sides of the river and agricultural lands. the last station S3 is located at the end of the river within the district and the advantage of the river in this region shortness beach. (figure 1.)

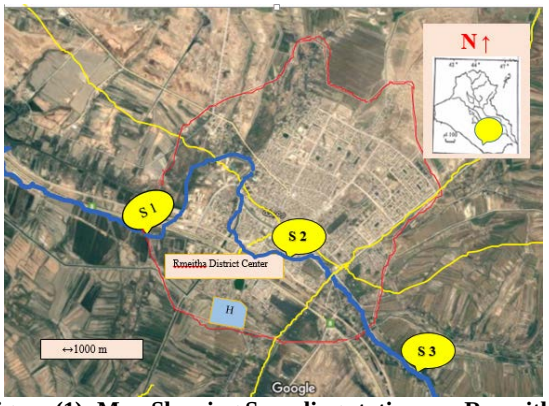

Figure (1): Map Showing Sampling stations on Rumeitha River

2.2 Sampling Procedures

Water and bottom samples were collected monthly from the three study stations S1, S2, and S3 of Rumaitha River, from March 2017 to February 2018 (Figure 1). Benthic samples were collected using Ekman dredge (15X15cm), Monthly, during the same period of water samples, fixed 5% formalin in the field and preserved with 70% ethanol in the laboratory, the worms were identified to species level according to [19, 20] then counted and expressed by (Individual/m^2). collection depending on a procedure that has been described [21]. Water samples were taken to the laboratory to analyze and according to [22] water temperature was measured (° C), pH, and the values of Dissolved oxygen (D.O) and Biochemical Oxygen Demand (BOD5).Using modification Sinclair method -Azide as in [22] and expressed the result in mg / L. Total organic carbon in sediment were measured and expressed as a percentage of dry weight .In terms of electrical conductivity values of water, the salinity values (‰) were calculated.

2.3 Statistical analysis:

Pearson correlation coefficient (r) was used to correlate physicochemical parameters and density of Tubificidae. By using SPSS 14.0 software at 5% to compare the means of physiochemical parameters measured and used to test the significance of differences. Species diversity index was calculated from the Shannon-Wiener Index, H'= -Σ (ni / N) ln (ni / N), ni = number of members of each species, N = Total Number of individuals in the sample.

Sorensen Similarity was used to determine the similarity in stations taxa composition. S = 2J/ (a + b) * 100, where J=number of common species occurred in both station. A= number of species in (a) station. B= number of species in (b) station.

The frequency of benthic occurrence species was calculated by using the F index which described by (Muniz and Venturina, 2001): F= Pa/P *100, where: Pa= is the number of the station where the species occur and P is the total number of sites. Using this formula, the species were classified in: Constant species (F > 50%), Common (10 < F < 49%) and Rarely species (F < 10%).

Measurement of Specific Disability: The Kothe's equation was used to assess the specific deficit (F) as cited in Meynell.(1973)

$$F = 100 \times \frac{(A_1 - A_x)}{A_1}$$

Where: A_1: number of species in station 1. Ax: number of species in another station.

RESULT AND DISCUSSION

Physical and chemical properties of water and riverbed: -

The Euphrates River in the city of Al-Rumaitha did not receive adequate environmental studies, especially in studies related to the biological diversity of the Tubificidae worms. Therefore, it is difficult to compare the results obtained in this study with the very rare studies of the river. Especially as the limnological characteristics of the river and its surrounding Tubificidae are affected by the seasonal and local changes of the river's environmental factors. [23]. The levels and rates of physical and chemical factors for the water of the studied river stations recorded the highest value of the water temperature river $32C^0$ at station S2 during the month of June and 2017 while the lowest temperature at station S1 11 m in February 2018 (Fig. 1). This temperature is significant in the dissolution of oxygen and other gases. Biology varies in their tolerance to temperature. As noted in the current study, the group Tubificidae family increased during spring and autumn. The effect of temperature was documented in many research works, and most of them agreed with the fact that the aquatic Oligochaetes breed and reproduce during spring and summer [10. 13]. The temperature recorded in the current study is similar to that recorded in previous studies the River Euphrates [24, 25]. The pH values recorded in the present study. They were within the limits of the system of water and public water conservation system from pollution. No. 25 of 1967 and the amendments thereto. It was also noted that the pH values were limited between 7.1 at station S 3 in November 2017 and 8.1 at station S1 in February 2018. The figure, 3. PH values with low-temperature cycling in river water were observed to have decreased during winter. Therefore, there are no significant differences between the pH values recorded in the current study in all study stations. The current study agreed with previous studies on other river water in Iraq because of the abundance of bicarbonate and carbonate ions [1,9]. The electrical conductivity values (Fig. 4) and salinity (Fig. 5) in the three study stations are higher than the electric conductivity and salinity values on the Euphrates River [26]. The rise in salinity in the summer and fall may be due to the decrease in the water level in the river and increase the outputs of aquaculture activity, and this is consistent with what he found [9] in the river Diwaniyah. The values of the bio-oxygen requirement are negatively correlated with the amount of dissolved oxygen. The results of the current study showed an increase in BOD values in general during the hot months, with a maximum value of 5 mg / L at station S2 in June 2017, Figure 7. This may be due to the exposure of the river during its run to many pollutants and organic matter received Directly or indirectly. Comparative rates were recorded for the current study in the Asi River in Nigeria [27], and pollution and temperature [1]. Statistical analyzes showed no significant differences in the percentage of organic matter in bottom sediments in all study stations. The ventilation was good in the river with a decrease in the values of the biological requirement of oxygen while the pH was in the base side. No significant differences were observed between the measured physical and chemical properties, which had a positive effect on the diversity and density of aquatic organisms studied in the study stations. [5, 28].

3.2 Species and quantities of benthic Tubificidae

In the current study of the Tubificidae family of class aquatic Oligochaetes on the Rumaitha River,nine species of five genera were recorded namely *Aulodrilus (1,Species), Branchuira, (1,Species) , Limnodrilus (4,Species) , profundicola, (1,Species) ,Tubifex(1,Species).*Table 1,2 and 3 . In the station S1, all species except L. profundicola were recorded, whereas in station 2 there were only 5 species. This may be due to that which is under the influence of the remnants of the city, while in station S3, there were seven species, while only 5 species were collected at station S2. The rate of the annual density of worms were, 99, 72, and 84

indv/m^2 recorded at study station S1, S2 and S3 respectively, Figure 9. In the present study, it was observed that species that had the ability to live in a variety of environments and have pollution tolerance recorded the highest percentage of annual density within the species register. The highest annual percentage density within Tubificidae species was 31% for the species L. *hoffmeisteri* , followed by *T. tubifex* , which recorded 22% ,Tthe two species had the ability to live in polluted environments. Ibrahim, 2005. Martin. *et al*.,2008. indicated that Limnodrilus hoffmeisteri, which is widely used as an indicator of organic pollution, composed more than 75% of samples [9, 17]. While the species *Limnodrilus claparedianus, L. profundicola and Tubifex ignotus*, recorded a 1% for each species of them, Figure 10. This has been confirmed by the negative correlation in the current study, especially in Station 2, which is under the influence of the remnants of the city, which is directly into the river without treatment. Tubificidae is often affected by environmental changes. This makes them a good field for studying the interrelations between environment and Tubificidae. Ibrahim, (2005). noted that the bottom of the river provided with a layer of organic matter covering the bottom forming a good environment for the growth and breeding and affecting the distribution of many freshwater Tubificidae ,This was confirmed by the negative correlation in the present study[9].

Table 1: Monthly recorded of Tubificidae species in Station S1.

Taxa	2017										2018	
	M	A	M	J	J	A	S	O	N	D	J	F
Phylum Annelida												
Class : Oligochaete												
Family Tubiticidae												
Aulodrilus plurisseta	+	+	+				+	+	+	+	+	+
Brachyura Sowerby			+	+	+	+	+					
Limnodrilus claparedianus	+	+							+	+		
L. hoffmeisteri	+	+	+	+	+	+	+	+	+	+	+	+
L. undekemianus	+	+	+	+	+	+	+	+	+	+	+	+
L. profundicola												
Potamothrix hammoniensis	+	+	+	+	+		+	+	+	+	+	+
Tubifex ignotus		+	+									
Tubifex tubifex	+	+	+	+		+	+	+	+	+	+	+
Total number of taxa	6	7	7	5	4	4	6	5	6	6	5	5

(+) = detected

Table 2: Monthly recorded of Tubificidae species in Station S2.

Taxa	2017										2018	
	M	A	M	J	J	A	S	O	N	D	J	F
Phylum Annelida												
Class : Oligochaete												
Family Tubiticidae												
Aulodrilus plurisseta												
Brachyura Sowerby				+	+	+	+	+				
Limnodrilus claparedianus												
L. hoffmeisteri	+	+	+	+		+	+	+	+	+	+	+
L. undekemianus	+	+	+			+	+	+	+	+	+	+
L. profundicola												
Potamothrix hammoniensis	+	+	+	+	+		+	+	+	+	+	
Tubifex ignotus												
Tubifex tubifex	+	+	+				+	+	+	+		+
Total number of taxa	4	4	4	3	2	3	5	5	4	4	3	3

(+) = detected

Table 3: Monthly recorded of Tubificidae species in Station S3.

Taxa	2017										2018	
	M	A	M	J	J	A	S	O	N	D	J	F
Phylum Annelida												
Class : Oligochaete*7*												
Family Tubiticidae												
Aulodrilus plurisseta	+	+	+	+			+	+	+			
Brachyura Sowerby			+	+	+	+	+	+				
Limnodrilus claparedianus												
L. hoffmeisteri	+	+	+	+			+	+	+	+	+	+
L. undekemianus	+	+	+				+	+	+	+	+	
L. profundicola	+								+			
Potamothrix hammoniensis	+	+	+	+	+		+	+	+	+	+	+
Tubifex ignotus												
Tubifex tubifex	+	+	+	+			+	+	+	+		
Total number of taxa	6	6	7	5	2	1	6	7	5	4	3	2

(+) = detected

3.3 The Similarity Index and Species Diversity:

3.3.1 Sorensen Similarity:

Sorensen Similarity was used to determine the similarity in stations taxa composition It was observed that the highest value was 80% between stations S1 and S2 by scale Sorensen Similarity. Hamayoan *et all.* 2003. table (4). This parameter might have indicated that the similarity of benthic. fauna was quite low in all station along the river, The similarity index of benthic fauna in every pair of sampling sites was found to has an average of 36% .

Table 4: Sorenson similarity index (%) between sites during the studied period.

Stations	Sorenson similarity index (%)
S1,S2	76%
S1,S3	80%
S2,S3	62%

3.3.2 Species deficit (F):

The Specific deficit (F) between the stations elected during the study period. Of Tubificidae (S1, S2), (S1, S2 and (S3, S2) is shown in table 2 with the lowest value of the qualitative deficit 12.5 between stationS1 and station S3. This indicates that both station environment is suitable for the availability of more species than other river stations. The number of tubificidae species and the numerical abundance of one species at a particular site gives clear indications of water quality in that environment. The number of species in station S3 was seven species with a high density of Tubificidae worms Table (5), indicating a high percentage of organic contamination at this plant. Tubificidae worms do not prefer to live in low-polluted areas or the decline in species may be due to other influencing factors such as the presence of predators. This is what he found [9].

Table 5: Specific deficit (F) between the stations elected during the study period.

Stations	Species deficit
9S1,S2	37.5
S1,S3	12.5
S3,S2	29

3.3.1 Species Diversity:

It is possible to observe the decline in the biodiversity values of Tubificidae Species during the study period in the river. In addition, the low density of Tubificidae recorded in the current study when compared to what Ibrahim 2000, When he studied organic pollution in the Diwaniya River. In the current study, the lowest value of biodiversity was recorded 0.26 in July 2017 at the station S2, while the highest value was 0.37 at stations S1, S3 and in many months in the study period figure 11. Ibrahim, (2005) was noted that the numerical abundance and diversity of some Species of Benthos were affected by inappropriate physical and chemical changes and the degree of pollution, especially sensitive species [9] density of Tubificidae between stations during the study showed significant difference ($p<0.05$) between months in the density of all station in the study period. a significant correlation between the total number of individuals and some environmental measurements such as water temperature, dissolved oxygen, pH, salinity and the organic content of bottom sediments.

Finally, this study is the first of its kind in the Rumaitha River, so we propose periodic biological studies to determine the prevalence and density of different species of Tubificidae in the water body in order to develop a reference study for these groups by comparing published research and standardization of species in local studies.

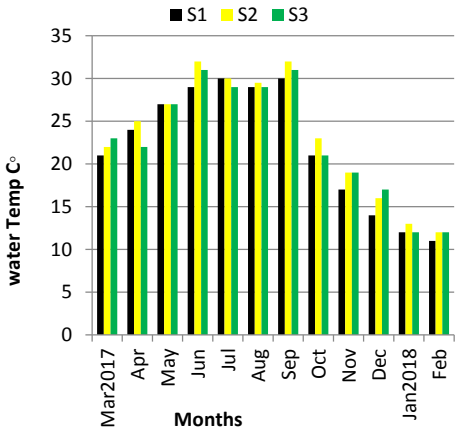

Figure 2: Months Variation in Water Temperature during study period

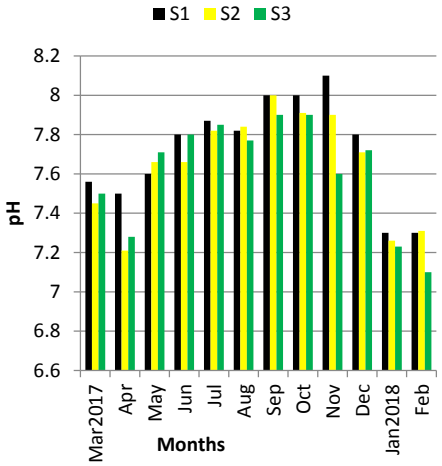

Figure 3: Months Variation in pH during study period

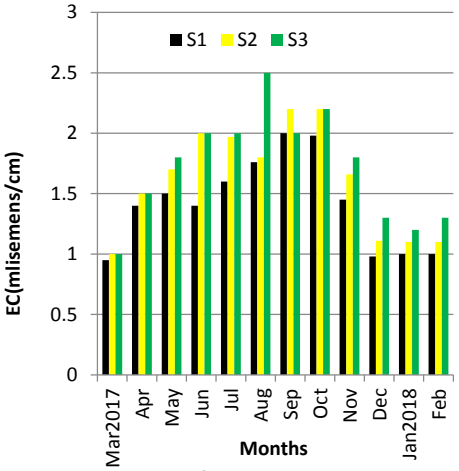

Figure 4: Months Variation in EC during study period

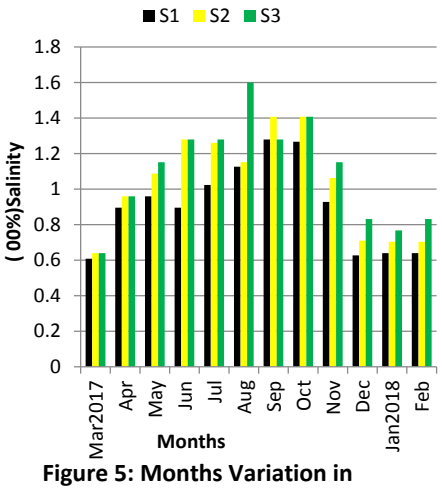

Figure 5: Months Variation in Salinity during study period

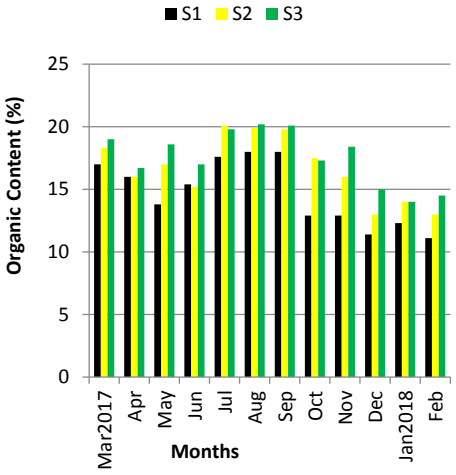

Figure 8: Months Variation in Organic Content (%) during study period

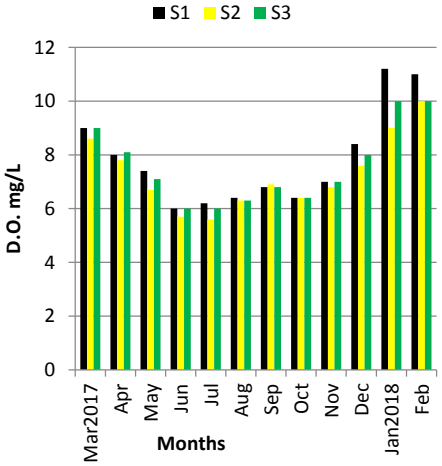

Figure 6: Months Variation in D.O during study period

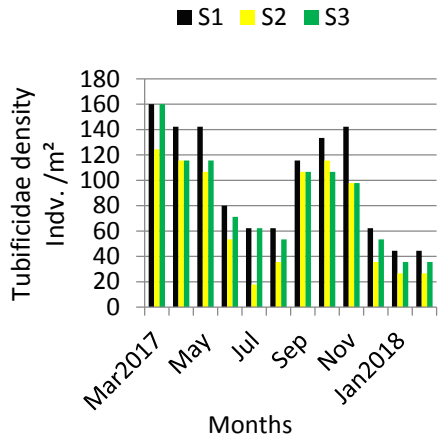

Figure 9: Months Variation in Tubificidae density Indv. /m² during study period

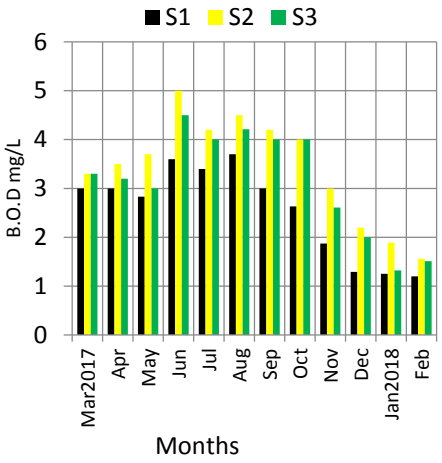

Figure 7: Months Variation in B.O.D. during study period

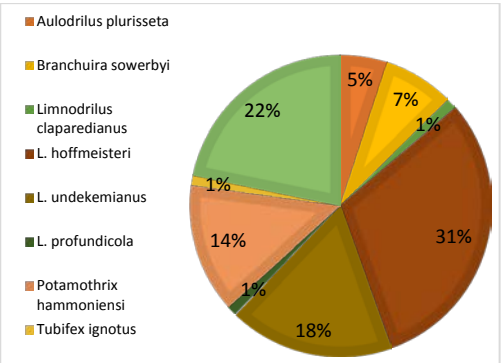

Figure 10 : Percentages Composition Of Tubificid Species During Study Period .

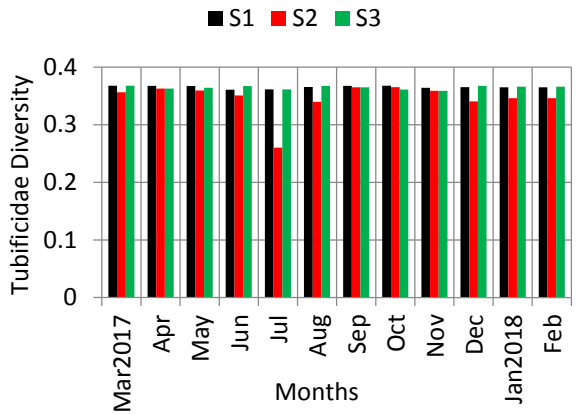

Figure 11: Months Variation inTubificidae Diversity during study period

CONCLUSION:

In the current study, the lowest value of biodiversity was recorded 0.26 at the station S2 in July 2017, while the highest value was 0.37 at stations S1, S3. Biodiversity was in low value and less than 1 at all stations.

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