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Studies of Rotifers Community Structure in Al-Shamiah River-Hilla/Iraq

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I. Introduction

The rotifers were an important plankton in feeding the young fish in fish hatcheries. And have a vital role in the food chain in the aquatic environment, and to study its presence in the important water bodies in estimating the abundance of food in the water and the validity of the investmewnt (Al-Lami *et al.*, 2002).

The importance of studying the diversity of ecological communities for any population to identify the nature of interlocking and complex relationships between different species in these communities, reflecting the role of these species in the ecosystem, in addition to the results of these studies it can be a good indicator of the stability of the ecosystem and the nature of the change in the various biotic and abiotic environmental factors that increase or decrease the biodiversity during different periods of time or in different regions could be adopted indicator of the changing nature of environmental factors (Thompson *et al*., 2004).

The study of qualitative and quantitative composition and biodiversity of the rotifera in Al-Shamiah River/Hilla City is the goal that brought the current study as an important component of the food chain in the aquatic environment.

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II. Materials and Methods

River Al-Shamiah is considered as the major surface water source in the this district and one of the main sources of irrigation, which classified within the water contained a large area, It is a land that depends on irrigated ends of the Hilla River (Al-Waaeli, 2005). This river enters the territory of Al- Diwaniya from the northwest, heading to the south. Along of 80Km and discharge capacity of 180 m^3/s (Al-Ebadi,2011).

Four stations were selected to collect samples of the Al-Shamiah River. The first station was located at the beginning of the entry of the river city. While the second was located about 15 Km from the first station. The third station away from the second to 18 Km. Fourth station was located about 20 Km from a third station (Figure 1).

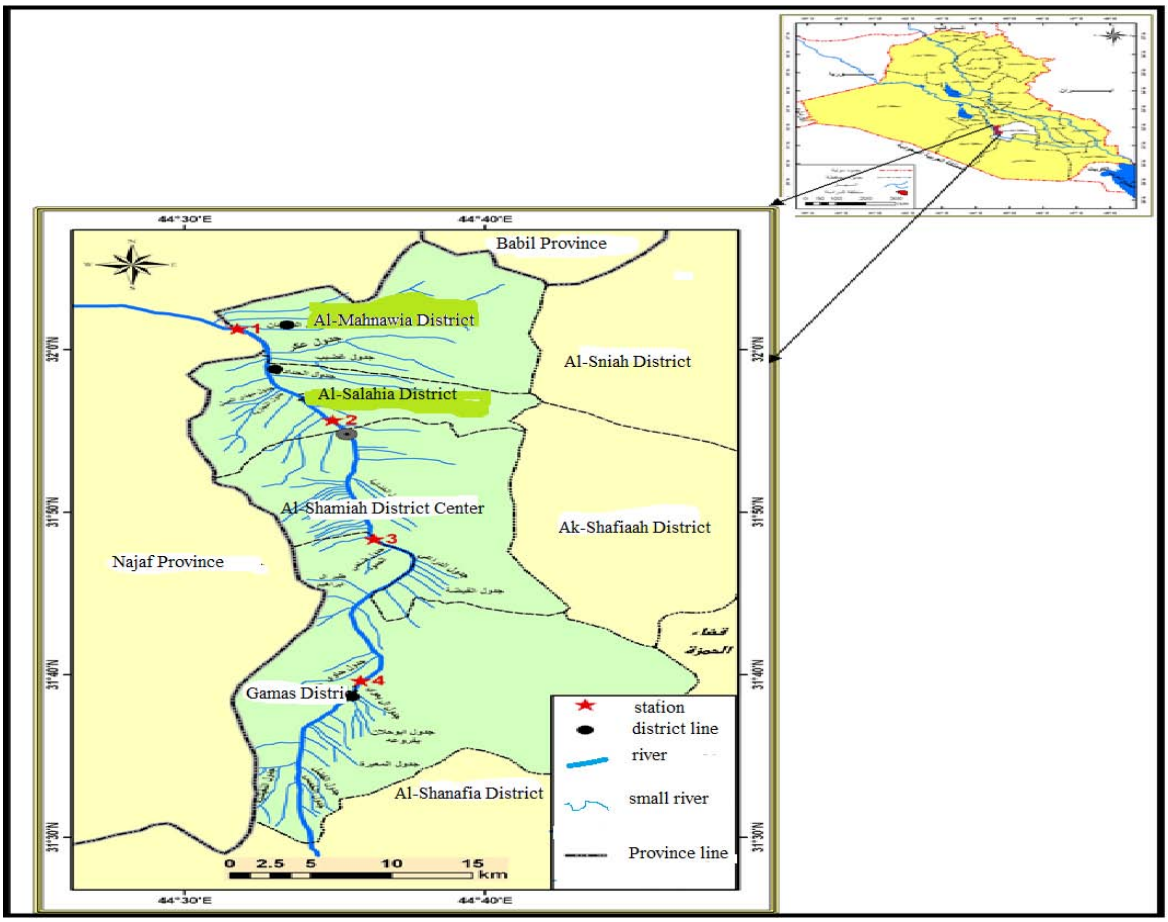

Figure 1: The study stations on the Al-Shamiah River/Iraq

For the purpose of studying the biodiversity of rotifera, it has been passed of 40 liters of water in the zooplankton net type (Hydro-bios) diameter openings pore about 55 microns. Samples are concentrated to 10 ml were diagnosed all respondents and counted using a compound microscope type Olympus depending on Edmondson (1959) Pennak (1978), Pontin (1978) and expressed the results of an Individual/m^3 (m^3 /Ind.).

Environmental indicators were accounted as follows: (1) Relative abundance index (Ra): According to the formula contained in the Omori & Ikeda (1984). (2) Constancy index (S): Was the presence and frequency of each type of account according to the formula contained in the Serafim *et al*. (2003). (3) Species richness index (D): Calculated monthly according to the formula contained in Sklar (1985). (4) Shannon Wiener index of diversity (H): Monthly calculated from this value used the Shannon Weiner equation as stated in Floder & Sommer (1999). Results expressed as bits/individual. The bit is equal to one piece of information), and values less than 1 bit, means have low diversity, while more of 3 bits means high diversity. (5) Species uniformity index (E): This index is calculated according to the formula contained in the Neves *et al*. (2003) considered as values greater than 0.5 as equal or homogeneous in appearance (Proto-Neto, 2003).

III. Results and Discussion

The difference in the densities of zooplankton may be due to several factors, including the physical and chemical properties of water , food, competition, predation and parasitism (Herzig, 1987). The density of rotifer ranged in Al-Shamiah River between lower density reached 175 Ind./m^3 in January 2013 at the station 3, and the highest density 27,650 Ind./m^3 at the station 1 in September 2012 (Figure 2).

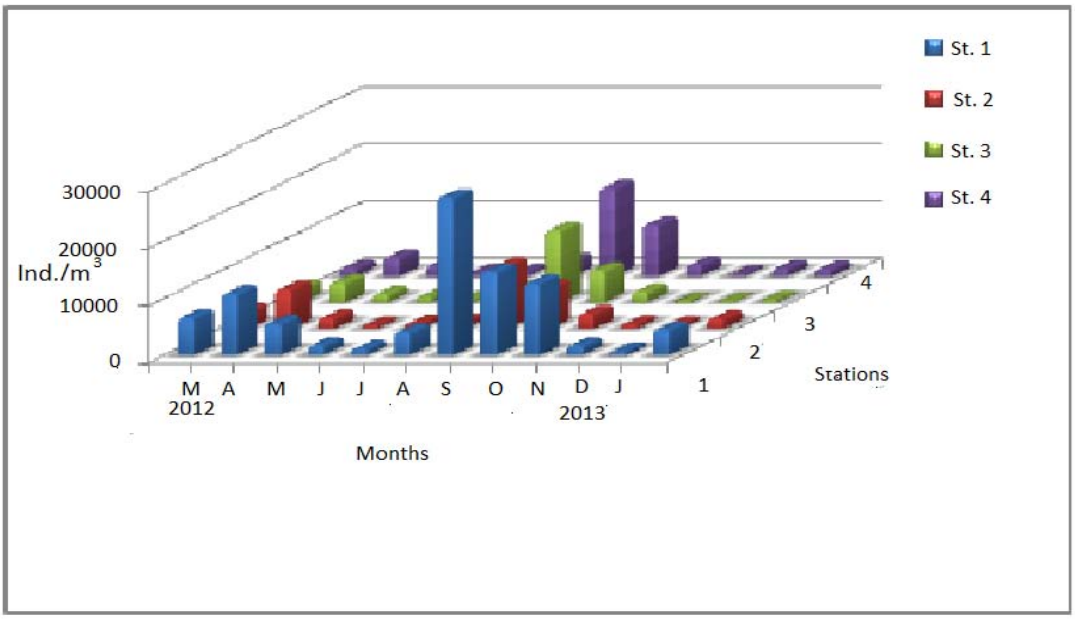

Figure 2: Total density of rotifera (Ind./m^3) in A-Shamiah Rive from March 2012 until February 2013

It showed that the relative abundance index (Table 1 and Figure 3) that the species *Keratella valga* scored the highest percentage compared with the total density of other species and recorded 12% in the first station, 21% in station 3, 14% in the station 3, 9% in station 4.

Table (1): Taxonomic units of rotifera in Al-Shamiah River, Relative abundance index (Ra Index) and Constancy index (S Index). Represent R = rare species (less than 10%), La = less abundant species (10-40%), A = species are abundant (40-70%), D = Dominant species (greater than 70%) A = Accessory species (1%-25%), Ac= Accidental species (25% - 50%), C = Constant species (greater than 50%)

	Ra Index				S Index			
Station / Taxa	1	2	3	4	1	2	3	4
Anuraeopsis fissa	R	R	-	-	A	A	-	Ac
Aspelta bidentata	R	-	-	-	A	-	-	-
Asplanchna priodonta	R	-	-	-	Ac	-	-	-
Brachionus angularis	-	-	-	-	C	Ac	Ac	Ac
B.bidentatus	-	-	-	-	A	-	-	A
B.calyciflorus amphiceros (long. spine)	R	R	-	R	A	-	-	A
B.calyciflorus amphiceros (short. spine)	R	-	-	-	Ac	Ac	Ac	C
B.calyciflorus calyciflorus	R	-	-	-	C	Ac	Ac	Ac
B. falcatus	R	R	R	R	Ac	Ac	Ac	A
B. haranansis	R	-	-	R	Ac	Ac	A	A
B. quadridentatus	R	-	-	R	Ac	A	A	A
B. rubens	R	R	R	R	A	-	A	A
B. urceolaris	R	R	R	R	C	Ac	Ac	Ac
B. zahniscri	R	R	R	R	-	A	-	-
Cephalodella auriculata	R	R	R	R	Ac	A	A	A
C . forficul	R	R	R	R	A	-	A	-
C . intuta	R	-	R	R	-	-	A	A
C. gibba	R	R	R	R	C	Ac	Ac	Ac
C .mucronata	-	R	-	-	-	-	-	A
C. Intilloides	R	R	R	R	A	A	-	-
Cephalodella sp.	R	-	R	-	A	-	-	-
Colurella adriatica	-	-	R	R	C	Ac	Ac	Ac

Station / Taxa	Ra Index				S Index			
	1	2	3	4	1	2	3	4
Colurella sp.	R	R	R	R	-	A	-	-
Dipluchlanis propatula	-	-	-	R	A	A	A	A
Euchlanis delatata	R	R	-	-	C	Ac	Ac	Ac
Filinia longiseta	R	-	-	-	A	A	-	A
F. opliensis	R	R	R	R	Ac	A	-	A
Hexarthra mira	-	R	-	-	A	A	-	A
Keratella cochlearis	R	R	R	R	C	Ac	C	Ac
K. hiemalis	R	R	R	R	Ac	A	A	-
K .palodsa	R	R	-	R	-	A	-	-
K. quadrata (long. spine)	R	R	-	R	A	A	A	A
K. quadrata (short. spine)	R	R	-	R	A	A	-	A
K. valga	R	R	R	R	C	C	Ac	C
Lecane depressa	R	R	R	-	A	-	-	-
L. elasma	-	R	-	-	A	A	A	A
L. hegurensis	R	R	R	R	Ac	A	Ac	Ac
L. latisema	R	R	-	R	-	A	-	-
L. luna	La	La	La	R	C	Ac	Ac	C
L .plosnensis	R	-	-	-	-	A	-	-
L.nana	R	R	R	R	A	-	A	-
L. ohionsis	R	R	R	R	A	-	A	A
L. rhombides	-	R	-	-	A	-	-	-
Lecane sp.	R	R	R	R	A	-	-	-
Lepadella depresa	-	R	-	-	A	-	-	-
L. ovalis	R	-	R	-	Ac	Ac	Ac	A
L. salpina	R	-	R	R	A	A	-	-
L . patella	R	-	-	-	A	-	A	-
Lophocaris salpina	R	-	-	-	A	-	A	A
Macrochaetus subqudratus	R	-	-	-	A	A	-	-
Manfredium eudactylotum	R	R	R	R	A	-	-	-
Monostyla bulla	R	R	-	-	C	Ac	Ac	Ac
M. closterocerca	R	-	R	-	Ac	Ac	Ac	A
M. lunaris	R	-	R	R	Ac	Ac	Ac	Ac
M. quadridentata	R	R	-	-	Ac	A	A	A
M. thalera	R	-	-	-	-	A	A	A
M. stenroosi	R	R	R	R	A	-	-	-
M. thienemanni.	R	R	R	R	A	-	-	-
Monostyla sp.	R	R	R	R	Ac	Ac	Ac	Ac
Monomata grandis	R	R	R	R	-	-	A	-
Mytilina mucronata	-	R	R	R	Ac	A	-	A
Notholca acuminate	R	-	-	-	A	-	-	A
N. squamula	R	-	-	-	A	A	-	A
Philodina roseola	R	R	R	R	A	-	A	A
Philodinavus paradoxus	-	-	R	-	A	A	A	-
Platyias patulus	R	R	-	R	A	A	A	A
P. quadricornis	R	-	-	R	A	A	A	A
P. polyacanthus	R	R	-	R	A	-	-	-
Polyarthra dolicoptera	R	-	R	R	Ac	-	A	A
P. vulgaris	R	R	R	-	Ac	Ac	A	Ac
Pomopholyx complanata	R	R	R	R	Ac	A	A	A

Taxa \ Station	Ra Index				S Index			
	1	2	3	4	1	2	3	4
P . sulcata	R	R	R	R	A	-	-	-
Rotaria neplunia	R	-	-	-	Ac	Ac	Ac	Ac
Scardium longicaudum	R	-	R	R	A	-	-	-
Synchaeta oblonga	R	R	R	R	C	A	A	Ac
Synchaeta sp.	R	R	R	R	Ac	Ac	Ac	Ac
Pedipartia gracilis	R	-	-	-	A	-	-	-
Testudinella patina	R	R	R	R	Ac	A	-	A
Trichocerca bicristata	R	-	-	-	Ac	Ac	Ac	Ac
T .capucina	R	R	R	R	A	-	A	-
T . cylindrica	R	R	R	R	A	-	A	A
T. insignis	R	-	-	-	-	A	-	-
T. longiseta	R	R	-	R	A	-	-	-
T. porcellus	R	R	R	R	A	A	A	Ac
T. smilis	R	-	R	-	-	-	A	-
Trichocerca sp.	R	-	R	R	-	A	-	-
Trichotria tetractis	-	R	-	-	Ac	Ac	Ac	Ac
Other Rotifera	R	-	-	-	C	C	Ac	Ac

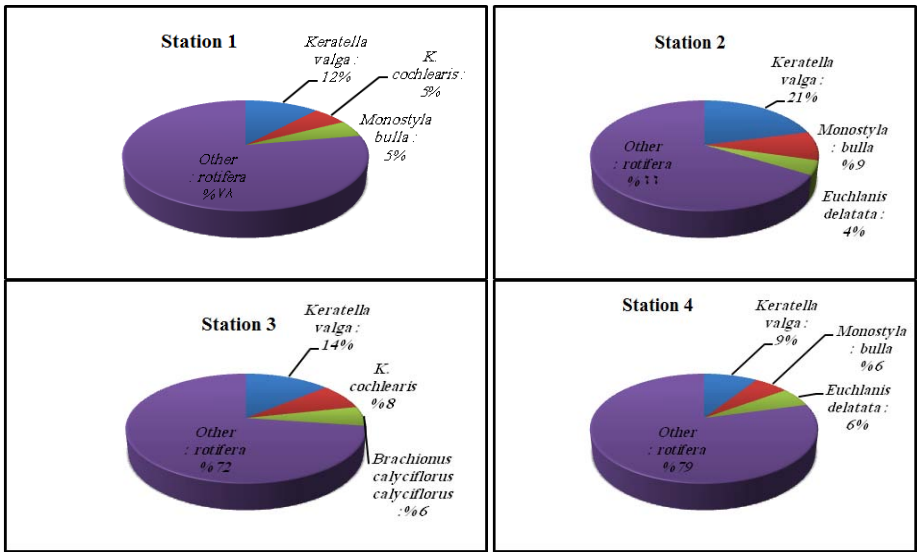

Figure (3): The relative abundance of dominant rotifers in Al-Shamiah River (March 2012 - February 2013)

The density of rotifera is affected directly and indirectly heavily by microscopic algae and other organisms, particularly bacteria, small minutes of organic matter due to its their feeding habits on algal cells, bacteria and small rotifera as well as organic debris (Ghazi and Ahmed, 2008).

The highest density recorded of rotifera was at station 1 in the Autumn season and this may be due to increasing the density of phytoplankton as the abundance daitomite in the rives, which lead to an increase in the density of rotifer because of the food relations, as well as environmental conditions of the rivers that are suitable for both (Sharma *et al.*, 2010). While the lowest densities were in the station 3 and this may be due to the discharge of waste from household into the river directed, and the accompanying rise in turbidity at this station (Noueir, 2001), in addition to the eutrophication and predation by fish and other invertebrates (Al-Shamma`a *et al*., 2011). As a seasonal variation, Winter record is a less dense group of rotifer especially in January, and this may be due to the low density of algae as well as, lower temperatures in this season (Honggang *et al*., 2012).

Recording disapear of the relative abundance index value for of the dominant species of rotifers which has not been able to reach the percentage of abundant

species or dominant depending on the relative abundance index gives evidence of the lack of environmental pressures in the river during the study period, which may result in an area appropriate for the bloom of certain species of resistance to these pressures and to achieve dommint on the other species (Rajagopal *et al.*, 2010).

Constansy index shows the extent of the stability of each species in the environment and a frequncy appearance. The endurance measurements and the availability of the species in the environment reflects the relative sensitivity to environmental disturbances, which may include a number of resistant species or non-resistance (sensitive to pollution), and note changes in taxonomic units, which show how the safety of any ecosystem (Barbour *et al.*, 1995).

Table (1) shows the most frequent and appearance species in the study stations like *Brachionus angularis, B.calyciflorus* (short spine), *B.calyciflorus calyciflorus*, *B.urceolaris*, *Cephalodella gibba*, *Colurella adriatica*, *Euchlanis delatata*, *Keratella cochlearis*, *K.valga*, *Monostyla bulla*, *Lecane luna* and *Synchaeta oblonga* which is constant species in Al-Shamiah River water, according to the constancy index, as it existed in more than 50% of the total samples in this study.

The results also show that the station 1 is the most-owned constant species whereas station 3 contened least one, the reason for this is that the station 1 is more stable ecologically from other stations through increase of total density and diversity of this station (Al-Saadi, 2013). Sterner (2002) shows that the presence of the species belongate of the genera *Monostyla, Mytilinia,Filinia* and *Euchlanis* indicate to the clean environment. As evidence of that kind of environment that is not absolute, as a matter of the taxonomic additive unit may turn out to provide a constant of the appropriate conditions (Hofmann, 1987).

The values of species richness index of rotifera species ranged in Al-Shamiah River between the lowest value 0 at the station 3 in December 2012, and the highest value 13.05 at the station 1 in September 2012 (Figure 4).

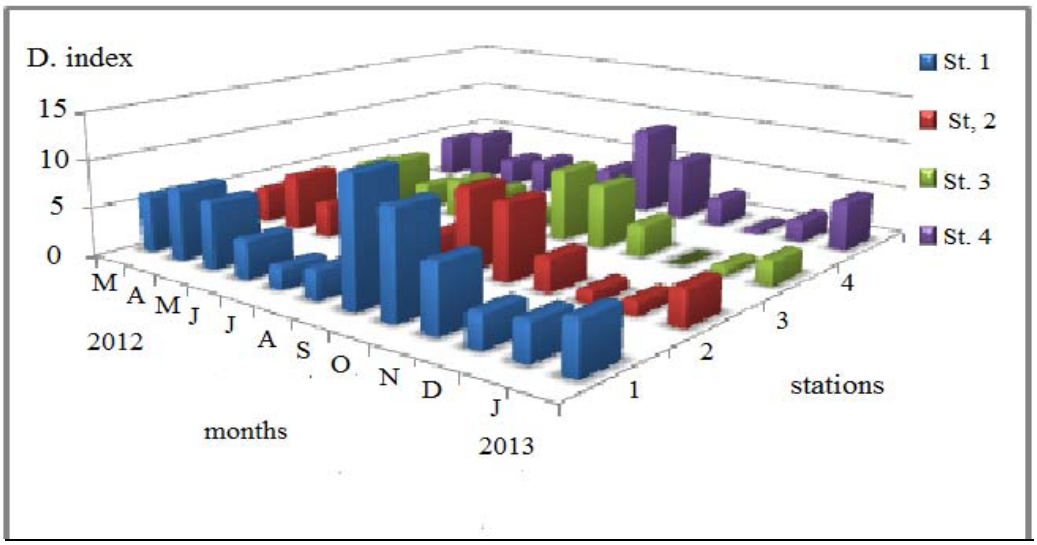

Figure (4): Monthly variations of the values of species abundance index (D) of rotifera (March 2012- February 2013)

The results showed a high index value for the species richness in the Spring and Autumn and this may be due to the increase primary productivity in these two seasons (Van Dijk and Van Zanten, 1995). And the number of rotifera differ in one water body for several years may be due to variation in the properties of the water, bottom and the abundance of nutrients (Al-Lami *et al.*, 2001).

The Shannon-Wiener index of diversity was the most biodiversity indicators commonly used, ranging from 0-5 and, when the value of this indicator is higher than 3 means that the composition of habitat is stable, and less than 1, it indicates a defect in the ecosystem caused by pollution (Turkmen and Kazanci, 2010). The values of Shannon-Wiener index of rotifera ranged between the lowest value 0-bit /Ind. at the station 3 in December 2012, and the highest value, 3.58 bits/ Ind. at the station 1 in September 2012 (Figure 5).

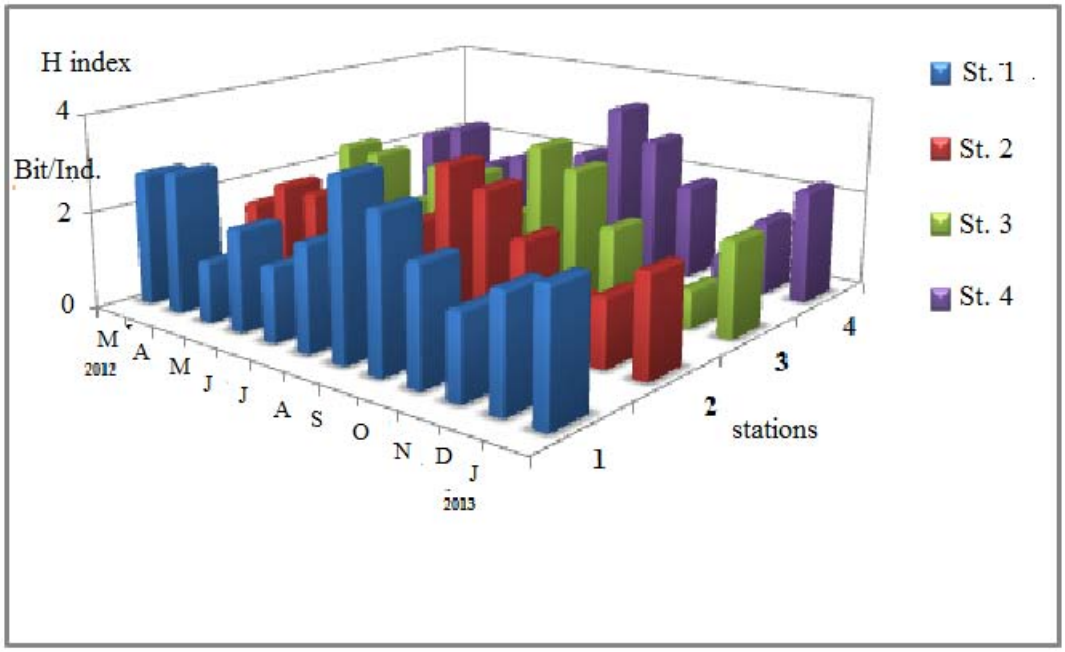

Figure (5): Monthly variations values of Shanon-Weiner diversity index (H) for rotifera in Al-Shamiah River from March(2012-February 2013)

The species uniformity index for rotifera ranged in Al-Shamiah River between the lower value was 0 at the station 3 in December 2012, and the highest value 0.94 at the station 3 in February 2013 (Figure 6).

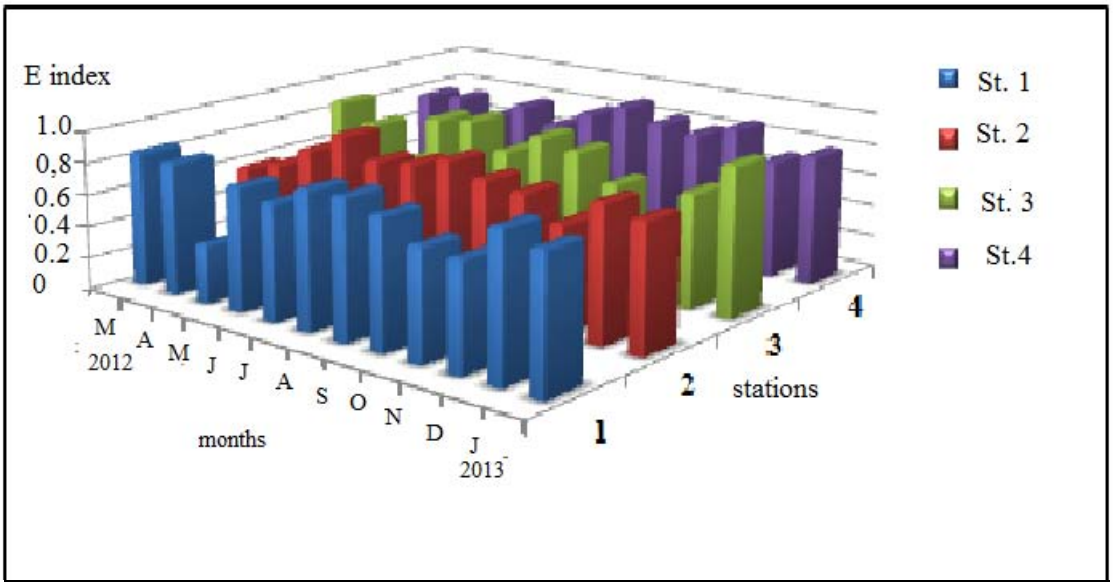

Figure (6): Monthly variations of the species uniformity index values for rotifera in Al-Shamiah River from March 2012-February 2013

The results showed presence of high values of Shannon-Wiener diversity index in the station 1 and 2, this may be due to favorable environmental conditions at these two stations because whenever the environmental conditions more stable and consistent increase diversity in the river (Trout-Haney, 2006). It's considered that the diversity of rotifera in Al-Shamiah River is good for this index.

The presence and diversity of aquatic plants lead to the formation of different environmental habitats, which is not homogeneous and is habitat by different zooplankton communities, while the recorded Shannon-Wiener index values at the station 3 may be due to the discharge of wastewater into the river, which caused pollution directly (Salman and Nassar, 2012). As well as the cause of the low Shannon-Wiener index values in the

station 3 may be due to an increase turbidity and total suspended solids at this station were considered as the reason of the lack of biodiversity (Neves *et al*. 2003). Also the increase in water transparency leads to increase in the diversity of zooplankton.

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