

Rotifers diversity at Shatt Al-Arab River and Shatt Al-Basrah canal, South of Iraq, during the abnormal rising of water salinity

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Abstract - This study was conducted during the period from November 2009 to March 2010 when the river of Shatt Al-Arab was subjected to abnormal rising in water salinity. The diversity of rotifers was studied in three different stations included two branches of Shatt Al-Arab River: Station 1 (Al-Asafia), Station 2 (Abu Al-Khaseeb-Jecor) and Station 3 (Shatt Al-Basrah canal). The highest values of water salinity (8.6, 16.7 and 22.5‰) were found during November 2009 in St. 1, St. 2 and St. 3 respectively and the lowest values (1.5, 1.9 and 2.8‰) were recorded in March 2010 in the three stations respectively. About 26 species of rotifers were diagnosed belongs to 16 genera, about 25 species recorded in St. 1 whereas, 13 and 12 species were recorded in St. 2 and St. 3 respectively. Jaccard's index showed presence of similarity of rotifers species between St. 2 and St. 3 compared to St. 1.

Keywords: Rotifers, diversity, Shatt Al-Arab, Shatt Al-Basrah canal, salinity.

Introduction

Rotifers are widely recognized as being important components of freshwater ecosystems, and whether this assessment is based on numbers or biomass, their contribution to tropic dynamics in these waters is striking (Wallace *et al.*, 2006) Although most species of rotifers inhabit fresh water, some species also occur in brackish (estuarine) and marine habitats (Fradkin, 2001; Ricci and Fontaneto, 2003). In estuarine and marine habitats, rotifers are generally thought to play a minor role in community dynamics ,therefore brackish and marine rotifers, with the notable exception of the *Brachionus plicatilis* species complex, have received a little attention worldwide (Sarma *et al.*, 2002). Few reports have been published on brackish and marine rotifers (Sarma *et al.*, 2000; García-Morales and Elías-Gutiérrez, 2004).

Because of their opportunism and adaptability, rotifers are widely distributed in freshwater planktonic habitats at densities that can exceed 1000 individuals per liter, and if sufficient food is available, occasionally can attain densities from 5000 to >15000 individuals/liter (Gulati *et al.*, 1992; Shao *et al.*, 2001). Ghazi and Ali (2012) investigated the rotifers of Shatt Al-Arab from Qurna to Fao through 12 months and listed 47 taxa and Salman *et al.* (2014) listed 105 species of Rotifera from the Southern Iraqi marshes. Ghazi and Ahmed (2008) studied the abundance and diversity of rotifers in ponds in Garmat Ali region and recorded 26 species. This study aimed to determine the diversity of rotifers during the water salinity changes in selected stations at Shatt Al-Arab River and Shatt Al-Basrah canal.

Materials and Methods

Sampling were carried out monthly from November-2009 to March-2010, from three stations of Basrah city includes two stations from Shatt Al-Arab, Station 1: Al-Asafia (30°34'49.50"N 47°45'6.00"E) at Garmat Ali region, Station 2: Abu Al-Khaseeb-Jecor (30°27'.74"N 48°0'28.31"E), and Station 3 (30°27'3.99"N 47°45'24.26"E) at Shatt Al-Basrah canal.

The water temperature (C°) and salinity (‰) were measured by YSI multi-meter model 2008. By standard towing plankton net of a mesh size 53µm, the net was towed for 20 meters distance, the collected specimens were fixed by 4 % formalin solution. Compound microscope was used for examination of the Rotifera. Description and identification of the species are based on Edmonson (1959) and Pennak (1989).

Jaccard's index was applied which represents the degree of similarity in species number between two stations as in the following equation according to Jaccard (1908):

$$Ss \% = (A/A + B + C) \times 100$$

A= Number of conjoint species between Stations1 and Station 2

B= Number of species which appeared in station1 and don't found in Station2

C= Number of species appeared in station2 and not found in Station 1

Results

Figure (1) represented the monthly variations in water temperature during the period study. The water temperature ranged between 16.8C° -25C° at the three stations. The lowest temperature was (16.8, 17.5 and 19.9 C°) recorded at Stations 1, 2 and 3 respectively in January 2010, whereas the highest temperature was (25, 24.8 and 23.9 C°) recorded at Station 1, 3 and 2 respectively in November 2009.

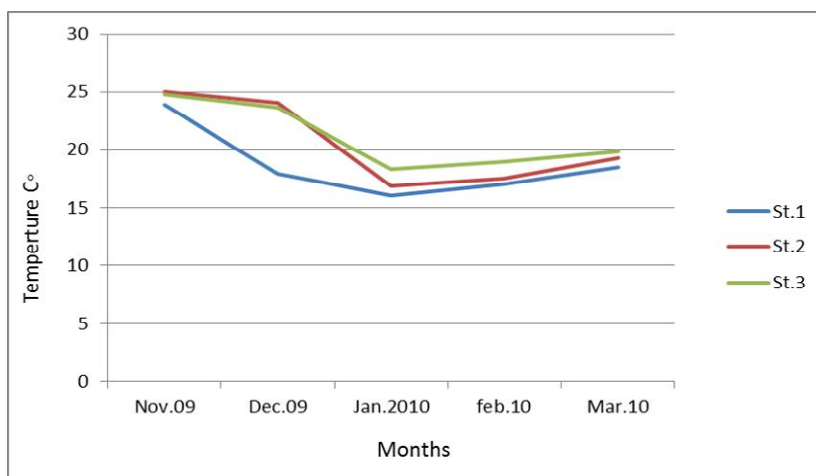


Figure 1. Monthly variations in water temperature at two stations in Shatt Al-Arab River and one station in Shatt Al-Basrah canal during Nov. 2009-Mar. 2010.

Monthly variations of salinity during 5 months of study are shown in Figure (2). The lowest concentration values (1.5, 1.9 and 2.8‰) were recorded at Stations 1, 2 and 3 respectively in March 2010, but the highest values (22.5, 16.7 and 8.6‰) were recorded at Stations 3, 2 and 1 respectively in November 2009.

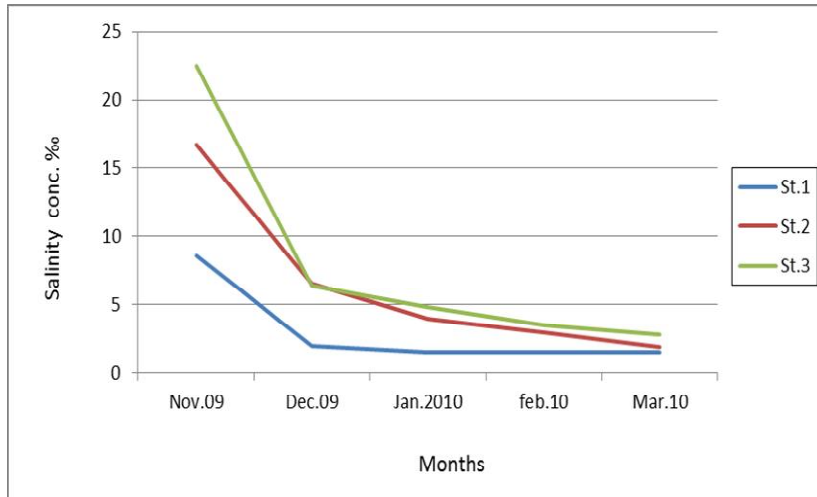


Figure 2. Monthly variation in salinity concentration at two stations in Shatt Al-Arab River and one station in Shatt Al-Basrah canal during the period from Nov. 2009 to Mar. 2010

Figures (3, 4 and 5), illustrate the percentages of rotifers species at the three stations during the study period from Nov. 2009 to Mar. 2010. The number of species was 25 in Station 1 (Al-Asafia), 13 in Station 2 (Abu Al-Khaseeb-Jecor) and 12 species in Stations 3 (Shatt Al-Basrah canal). The highest percentage was 20% for species *Asplanchna* sp. in Station 3, in Station 2 was 17% for the species *Brachionus plicatilis* and 13% for the species *Asplanchna* sp. in Station 1, whereas the lowest percentage was 3-4% for the other species in all stations.

Figure (6) shows the numbers of rotifera genus at the stations during 5 months from November 2009 to March 2010. The highest number (10 and 9 genus) was recorded at St. 1 in January and February 2010, whereas the lowest (3) was recorded at St. 2 in November and December 2009 and February 2010.

The occurrence and disappearance of Rotifera species in the three stations of Shatt Al-Arab river during the study period were shown in Table (1). Nine species of Rotifera (*Asplanchna* sp., *Brachionus angular*, *B. plicatilis*, *Keratella valga*, *Keratella* sp., *Monostyla* sp., *Notholca* sp., *Polyarthra* sp. and *Synchaeta* sp.) were replicated occurrence in the three stations, Whereas the other species were varied occurrence between stations.

The Jaccard's index of Rotifera (Ss%) is shown in Table (2). The highest similarity value was 47 between station 2 and station 3 and the lowest value was 37 between station 1 and station 3.

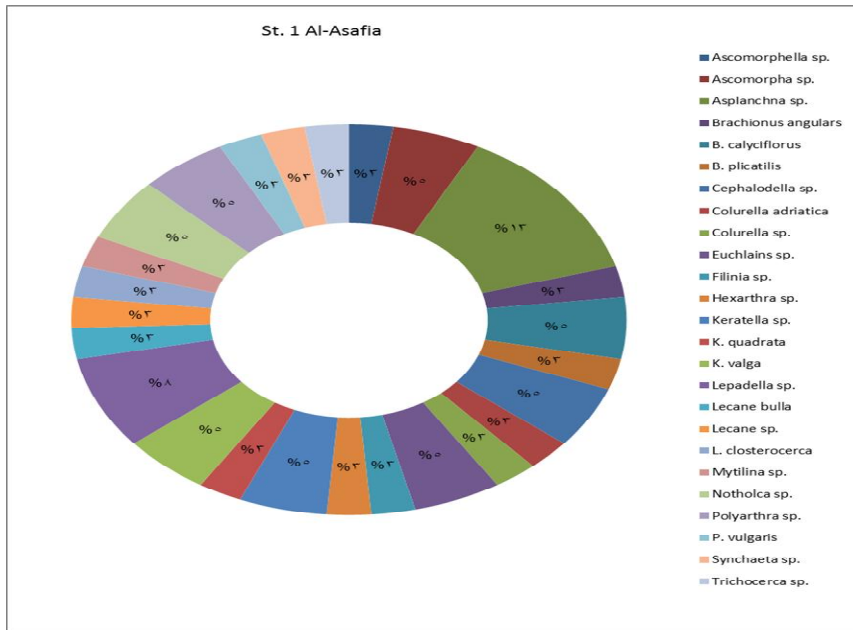


Figure 3. The percentage of Rotifera species in St. 1 (Al-Asafia) at Shatt Al-Arab River during the period from Nov. 2009 to Mar. 2010.

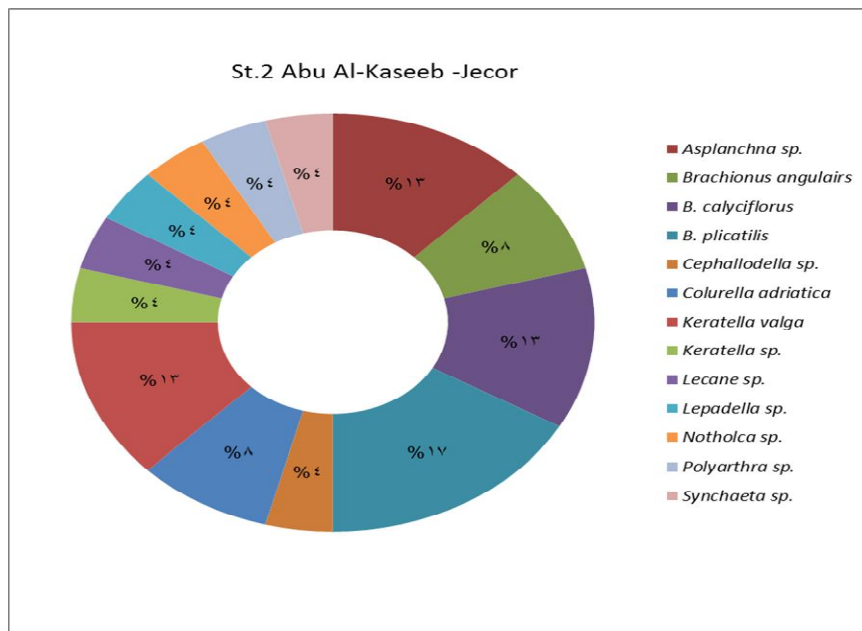


Figure 4. The percentage of Rotifers species in St. 2 (Abu-Khaseeb-Jecor) at Shatt Al-Arab River during the period from Nov. 2009 to Mar. 2010.

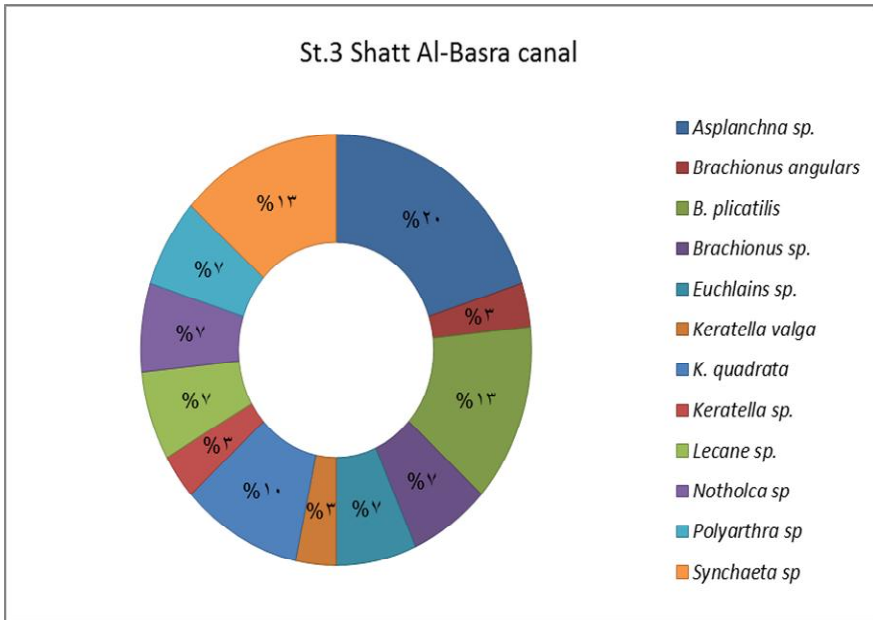


Figure 5. The percentage of Rotifers species in St. 3 Shatt Al-Basra canal during the period from Nov. 2009 to Mar. 2010.

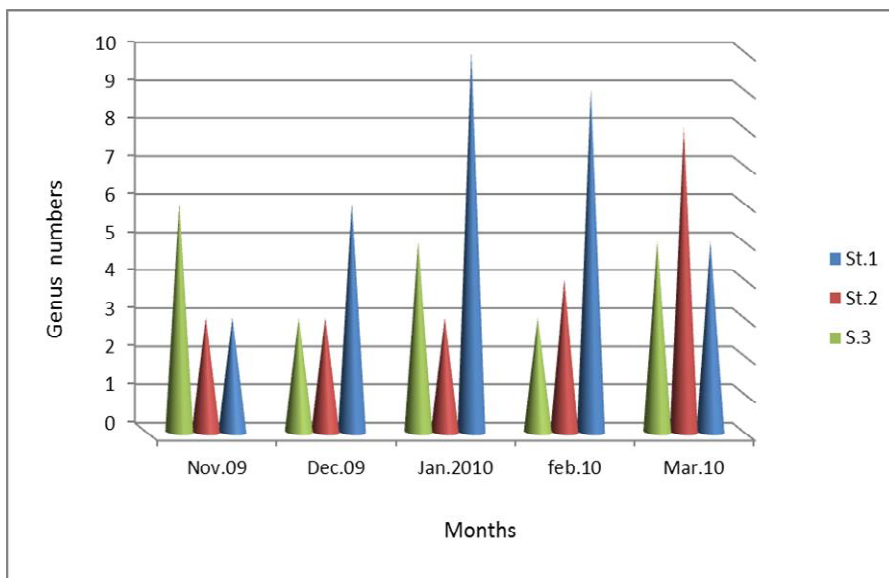


Figure 6. The changes of rotifera genus numbers between the three station (St. 1 Al-Asafia, St. 2 Abu Al-Khaseeb, and St. 3 Shatt Al-Basrah canal) during the period from Nov. 2009 to Mar. 2010.

Table 1. List of Rotifers species in two stations of Shatt Al-Arab river and Shatt Al-Basrah canal during Nov. 2009 to Mar. 2010.

Species	Stations		
	St. 1 Al-Asafia	St. 2 Abu Al-Kaseeb Jecor	St. 3 Shatt Al-Basrah canal
<i>Ascomorpha</i> sp.	+	-	-
<i>Ascomorphella</i> sp.	+	-	-
<i>Asplanchna</i> sp.	+	+	+
<i>Brachionus angular</i>	+	+	+
<i>B. calyciflorus</i>	+	+	-
<i>B. plicatilis</i>	+	+	+
<i>Brachionus</i> sp.	-	-	+
<i>Cephalodella</i> sp.	+	+	-
<i>Colurella adriatica</i>	+	+	-
<i>Colurella</i> sp.	+	-	-
<i>Euchlains</i> sp.	+	-	+
<i>Filinia</i> sp.	+	-	-
<i>Hexarthra</i> sp.	+	-	-
<i>Keratella valga</i>	+	+	+
<i>K. quadrata</i>	+	-	+
<i>Keratella</i> . sp.	+	+	+
<i>Lecane bulla</i>	+	-	-
<i>L. closterocerca</i>	+	-	-
<i>Lecane</i> sp.	+	+	+
<i>Mytilina</i> sp.	+	-	-
<i>Notholca</i> sp.	+	+	+
<i>Lepadella</i> sp.	+	+	-
<i>Polyarthra</i> sp.	+	+	+
<i>P. vulgaris</i>	+	-	-
<i>Synchaeta</i> sp.	+	+	+
<i>Trichocerca</i> sp.	+	-	-

Table 2. The Jaccard's index values of Rotifera between the three stations of Shatt Al-Arab River during Nov. 2009 to Mar. 2010.

	Station 1	Station 2
Station 2	40.7	
Station3	37	47

Discussion

Banse (2002) Concluded that a principal goal of ecology is to understand and be able to predict the abundance of organisms and the rate of changes that may occurred in them. Shatt Al-Arab River was consider as oligohaline brackish water by Reid (1961).

In the present study the salinity of Shatt Al-Arab region were extremely higher than those recorded previously (Al-Saadi *et al.* 1979; Al-Mosawi *et al.*, 1990; Al-Mosawi, 1992; Al-Mahmood, 2009) and that recorded later by researchers (Hammadi, 2010 and Hasan *et al.*, 2013). However, salinity values in station 3 was higher than most of inland water bodies in Basrah. Mohamed (1986) motioned that Shatt Al-Basrah canal was designed to decrease the flood from Tigris and Euphrates by discharge waters to Gulf through Khour Al-Zubair. Recently, this canal exposed to changes of increased salinity which caused by entering of sea water from Arabian Gulf.

The number of rotifers species were different between stations and the highest number was recorded in station 1 compared with stations 2 and 3. This results agreed with Ali and Ghazi (2012) whose found that the higher number of rotifera species was in Garmat Ali station and it increased in fresh or brackish water compared with marine water. Patil and Auti (2005) indicated that the environmental factors like temperature, transparency, total solids, salinity and dissolved oxygen play an important role in regulating zooplankton diversity and seasonal population densities. However, rotifer diversity in station 3 of Shatt Al-Basrah canal had not been studied before, in stations 2 and 3 the numbers of rotifera species were (13 and 12 species) respectively and nine species were associated between them. These results suggested that increasing salinity values in station 2 and 3, may be effects the related species between the two stations.

The monthly largest numbers of genus were (10 and 9) recorded at station 1, 8 at station 1, and 6 at station 3 in different months of the study, Salman *et al.* (2014) found that rotifera showed monthly changes in genus diversity. Station 1 (Al-Asafia) characterized by a suitable environmental conditions for rotifer to occurs in a high numbers of species and genera compared with the other two stations. Wallace *et al.* (2006) referred that rotifera as well as the other zooplankton prefer to live in the standing water.

About 7 genus of rotifers were record in the present study which are commonly found in Shatt Al-Arab, it is apparent that rotifera of the southern Iraq was dominated by ubiquitous and eurytrophic species that occur in fresh and saline waters with varied trophic states (Hammadi, 2010). The following rotifera species includes: *Asplanchna* sp., *Polyarthra* sp., *Brachionus angularis*, *B. plicatilis*, *Keratella* sp., *K. valga*, *Monostyla* sp., *Notholca* sp., *polyarthra* sp. and *Synchaeta* sp. Although, most of these species are cosmopolitans and euryhaline rotifers (Yalim 2006 and Segers 2007). *Brachionus angularis* is usually found in freshwater at temperate zone, when *Keratella quadrata* recorded in colder and salt water (Yalim, 2006), about 20 of 35 species of the genus *Synchaeta* are described as inhabiting marine or saline waters (Holloday, 2002) and *Notholca* sp., *Hexarthra* sp. and *Euchlains* sp. were recorded as seasonality species (Walsh *et al.*, 2008).

This study found that most of dominant species were from genus *Brachionus* and *Keratella* at the three stations and throughout the period of study, this corresponds with Ali and Ghazi (2012). Moreover, Salman *et al.* (2014) and Ghazi and Ahmed (2008) that *B. plicatilis* was the dominant species in re-flooded Mesopotamian wetlands and Garmat Ali ponds respectively.

The Jaccard's similarity index was used to compare the faunal similarity coefficients for the rotifera communities at the 3 stations. These coefficients indicated that stations 2 and 3 were very much similar to each other (47%) the

least similarity was obtained between station 1 and 3 the (37%) Similarity of water bodies is indicative if the value of the Ss% coefficient is greater than 50% (Póltorak *et al.*, 2001).

Conclusion

The results indicated that the number of rotifers species varied among regions and ecological structures of the aquatic environments. However, most of recorded genera have the ability to distribute in the three stations during the period of the study with exception of some species.

Ultimately the distribution of rotifers must be related not only to the physiological requirements, but also to their capacity for passive dispersal and ability to invade an established community (Segers 1996 ; Shurin, 2000).

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تنوع الدولابيات في شط العرب وقناة شط البصرة، جنوب العراق خلال فترة الارتفاع الشديد لتراكيز ملوحة المياه

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المستخلص - أجريت هذه الدراسة خلال فترة تعرض شط العرب الى ارتفاع شديد في تراكيز الملوحة حيث درس تنوع الدولابيات للفترة من تشرين الثاني 2009 ولغاية آذار 2010 في ثلاث محطات مختلفة شملت فروع من شط العرب في نهر العسافية (المحطة 1)، منطقة أبي الخصيب-جيكور (المحطة 2) وقناة شط البصرة (المحطة 3). قيست تراكيز ملوحة المياه وبلغت أعلى القيم (8.6 و 16.7 و 22.5 غم /لتر) في المحطات الأولى والثانية والثالثة على التوالي خلال شهر تشرين الثاني 2009 ثم بدأت بالانخفاض تدريجياً إلى (1.5 و 1.9 و 2.8 %) خلال شهر آذار 2010. شُخص 26 نوع من الدولابيات تعود إلى 16 جنس في المحطات الثلاث، سجل أعلى تنوع (25 نوع) في المحطة الأولى وأقل تنوع للدولابيات (12 و 13 نوع) في المحطة الثانية والثالثة. أظهر دليل جاكارد وجود تشابه في انواع الدولابيات بين المحطتين الثانية والثالثة مقارنة بالمحطة الأولى.