



## Environmental Study of Zooplankton in the Middle Part of the Shatt Al-Arab River, Basrah, Iraq

Alaa A.A. Maytham ; Naeem S.Hammadi\* & Jassim M. Abed

Department of Fishers and Marine Resources, College of Agriculture, University of Basrah

\*Corresponding author e-mail: [nae71em@yahoo.com](mailto:nae71em@yahoo.com)

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**Abstract:** An environmental study of zooplankton on the Shatt al-Arab River was carried out in two stations from July until November 2018. A total of 34 taxa of zooplankton were recorded in this study, belong to Cladocera, Copepoda and Rotifera. Some species have disappeared and others have emerged during the study period but varying numbers of dominant species found during the search such as *Acarocalanus gibber*, and recorded in the station 1 in July and station 2 for all months such as cyclopoid nauplii of Copepoda. Water temperature ranged between (19-35) °C station 1 and between (18- 32) °C at station 2, Salinity values fluctuated between (4.05 and 15.42 ‰), (6.47- 12.2 ‰) at stations 1, 2 respectively. pH values ranged was between (7.3 to 7.9) and (7.1 to 8.5) at stations 1 and 2 respectively. Copepoda density ranged between (0.12 to 88.23) ind. l<sup>-1</sup> at station 1 and between (0.94 to 69.73) ind. l<sup>-1</sup> at station 2. Density of Cladocera fluctuated between (0.06 and 1.45) ind. l<sup>-1</sup>. Maximum and minimum densities were at station 1. The population density of Rotifera ranged between (0.06 ind. l<sup>-1</sup> to 20.44) ind. l<sup>-1</sup> at second station.

**Keywords:** Zooplankton, Shatt Al-Arab river, Cladocera, Copepoda, Rotifera, Iraq.

## Introduction

Zooplankton is considered one of the most important sources of food for aquatic organisms especially the fish. Zooplankton community is the main source of energy flow in the plankton-based food Web, which makes it an important component of aquatic ecosystem (Santos-Wisniewski *et al.* 2006). and as an indicator of water quality in aquatic environment for several years. Some species thrive in nutrient-rich waters while others are highly sensitive to chemical or organic waste. Because of her short life cycles, planktons are quickly respond to environmental changes and will likely indicate species composition to block the water quality. A profound effect on

some non-biological aspects of water quality such as colour, smell and taste. The most obvious effects are the spread of harmful algal blooms and oxygen deficiency due to insufficient number of zooplankton. Zooplankton can be used to evaluate the overall health of the water body. So, they play a vital role in aquatic ecosystem by forming an important link in the food chain from primary level to the third level leading to fishery production which depend directly or indirectly on zooplankton (Gajbhiye, 2002).

Zooplankton play a big role in the ecosystem. It links primary products (phytoplankton) with the higher levels in the

food chain. It is responsible for a wide range of disorders that permeate the food situation for any level, the relationship between the *al.*, 2006). Hammadi (2016 a, b) studied the Rotifera from some selected regions in the middle and south of Iraq. Hammadi (2010), Hammadi & Bielańska-Grajner (2012) and Hammadi, *et al.* (2016) studied Rotifera in the Shatt Al-Arab. this study was conducted due to the absence of recent studies on zooplankton in the Shatt Al-Arab.

## Materials & Methods

### Study Area

The current study was completed on the Shatt Al-Arab river, which passes through the city of Basrah where is the vital source and estimated area around Shatt Al-Arab one million square kilometres and include agricultural land on both sides of an area configured so downstream (Hassan, 2007). The river consists from the confluence of the Tigris and Euphrates rivers north of Basrah, at

activity of these neighbour hoods and analyse the irretrievably lost. It is a model of success and the extent to which plankton (Ramfos *et* Qurnah city, and flows into the Arabian gulf, south of Faw city and unaffected by water transport operations put untreated waste from different sources. Two stations were selected for this study (Fig. 1) is near Al-Sindibad island, on the coordinates "N 30°34'18.4872", E 47°46'44.9292 there are agricultural areas from the east that pour into this site, large amounts of water from agricultural puncture In addition to thermal flows from Al-Nagibbyah power station as well as the presence of heavy water plant reeds and *Phragmites australis* is presence. The second station is near Al-Sadr Educational Hospital, on the coordinates N30°30'34.6608", E74°51'7.2108"there is big population proximity so they receive large amounts of persistent organic pollutants, of movement of small boats in the area besides Sadr hospital waste, lack of aquatic plants in the area.

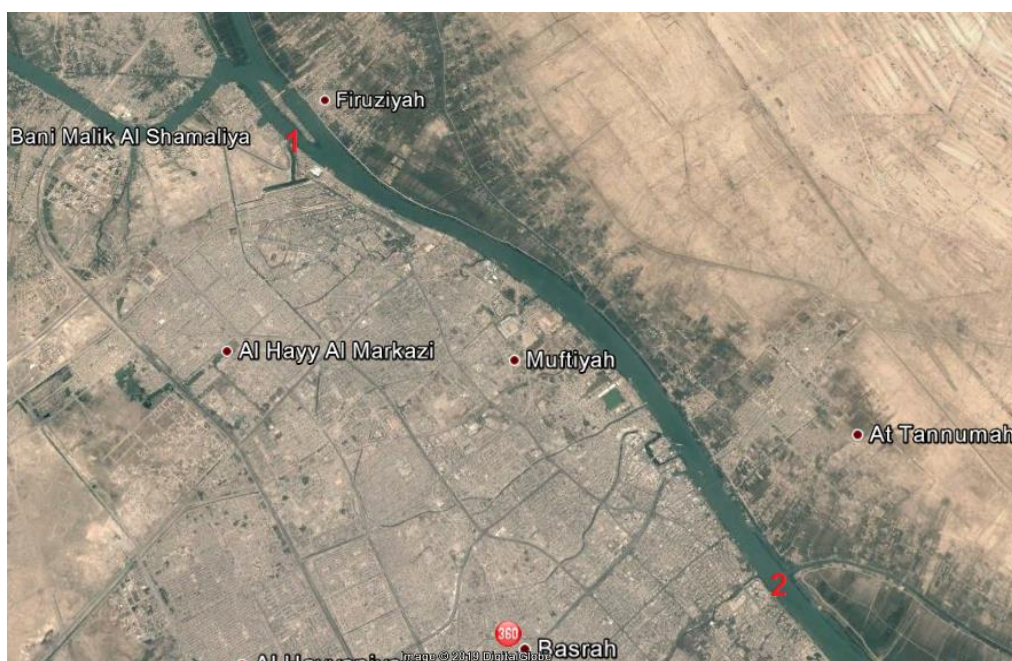


Fig. (1): Map of study area.

### Environmental study

Water temperature was measured by using simple mercurial thermometer (0-100)°C. Salinity was measured using a salinometer WTW type, German origin and the results is expressed in g/l. pH-meter was used to measure Hydrogen exponent degree.

### Quantitative and qualitative study of zooplankton

zooplankton samples collected Monthly during the period study by using net mesh size 50 microns' mouth aperture. The zooplankton sample transferred in a containers and immediately fixed in formaldehyde in the laboratory samples were examined by using a glass slide and counted with a Sedgwick-Rafter slide under a compound and dissecting microscope. The Taxonomy of zooplankton were dependence on some references: Fernando (2002), Al-Yamani & Prusova (2003) and Hammadi (2010).

### Statistical Analysis

Variance and correlation analysis using SPSS was used to determine correlation coefficient and differences between stations and between environmental factors and zooplankton density.

### Results

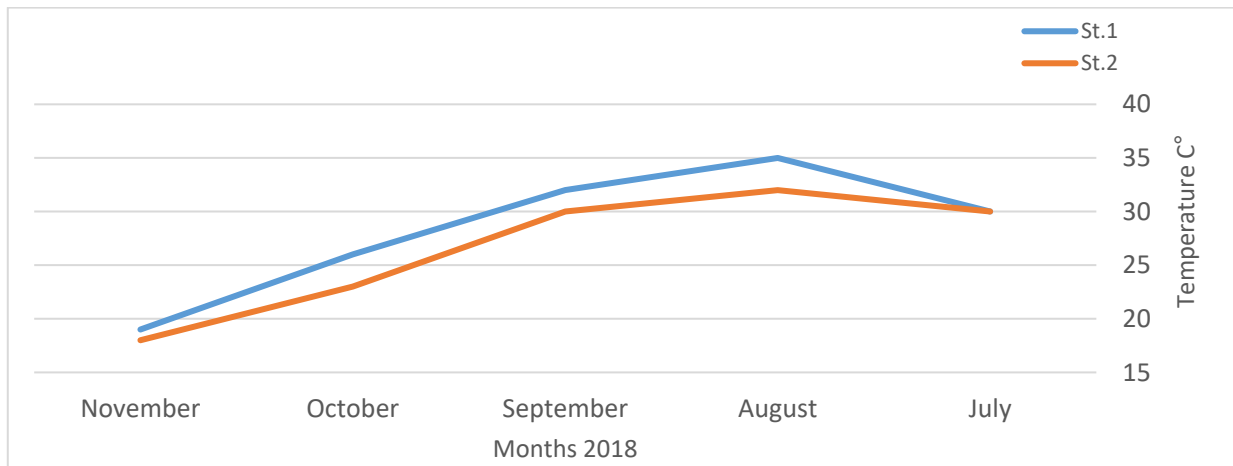
Fig. (2) was showed monthly changes in water temperature during sampling period. Station 1 was recorded a minimum values 19°C in November and maximum 35°C in August, while second station was recorded a minimum values 18°C in November and the highest 36°C in July.

Fig. (3) was showed monthly changes in hydrogen exponent during sampling period, the highest value is 8.5 were recorded in October at station 2, while the lowest value is 7.1 were recorded in November at station 2 too.

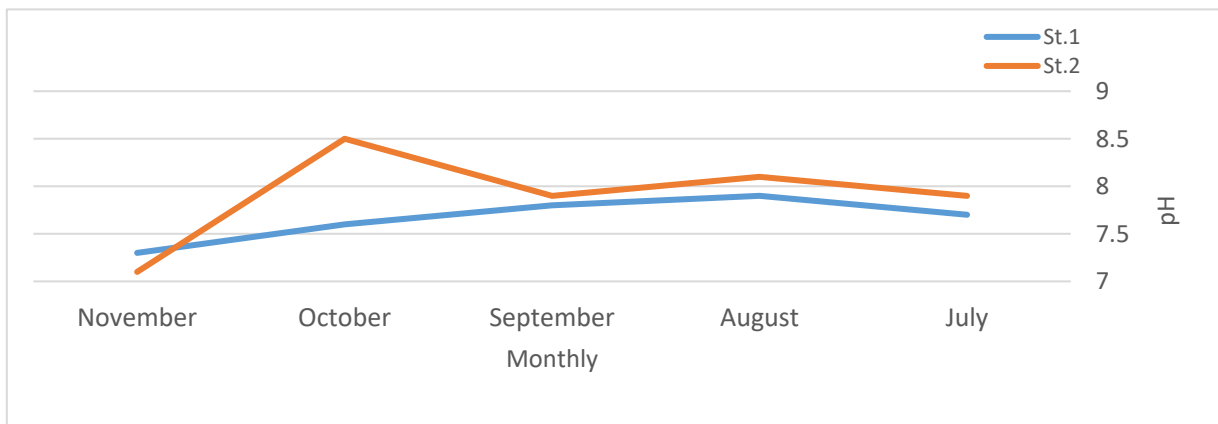
Fig. (4) was showed the monthly changes in salinity values during the sampling period. The lowest value is 4.05 g/L during July, the highest is 15.42 g/L in September, both values recorded in station 1.

Fig. (5) was showed the monthly zooplankton density, which ranged from (0.31– 101.49) ind/l at station 1. And (1.18-87) ind. l<sup>-1</sup> at stations 2.

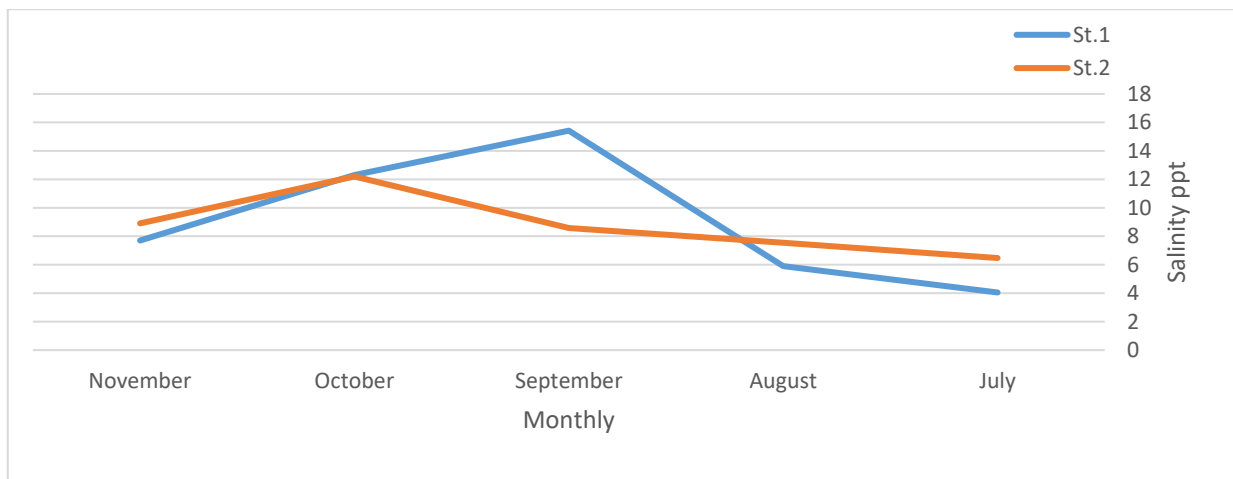
A total of 34 taxa were diagnosed in this study, 13 of them to Copepoda, 12 to Rotifera, 5 to Ostracoda, 2 to miscellaneous groups and 2 to the Cladocera (Table 1). The highest density of Cladocera was recorded in the second station during October was 1.45 ind. l<sup>-1</sup>. Copepods and Rotifera appeared throughout the study period, the highest density of copepoda was reached 88.227 ind. l<sup>-1</sup> at the first station in October and the lowest density was 0.12 ind. l<sup>-1</sup> in August. The highest densities of copepoda were larval stages called Copepoda nauplii throughout the collection period of samples. The highest density of Rotifera was 20.44 ind. l<sup>-1</sup> in November at the second station, but it did not appear in the first station in August. Ostracoda appeared only four times during the study period, the highest density of Ostracoda was 0.13 ind. l<sup>-1</sup> at station 2 in November. The highest density of the miscellaneous groups reached 0.5 ind. l<sup>-1</sup> at station 1 in July.



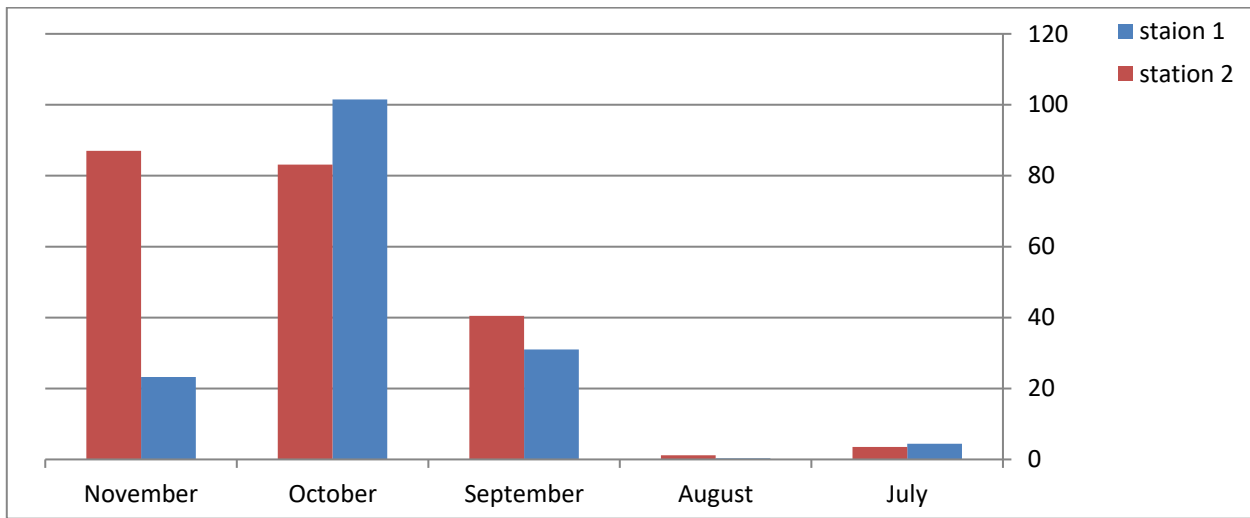
**Fig. (2): Monthly variations in the water temperature during July- November in the two stations study.**



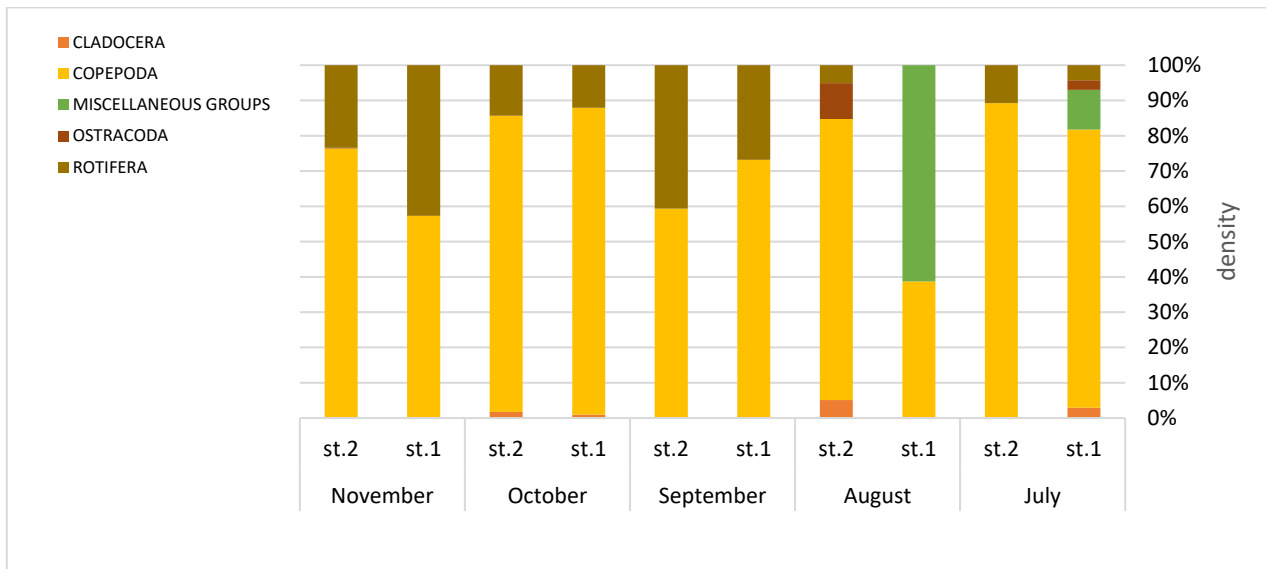
**Fig. (3): Monthly changes in pH values during July-November in the two stations study.**



**Fig. (4): Monthly fluctuations in salinity values during July-November in the two stations study.**



**Fig. (5): Monthly variations of zooplankton density (ind. l<sup>-1</sup>) at stations 1 and 2, in the Shatt Al-Arab River during July-November 2018.**

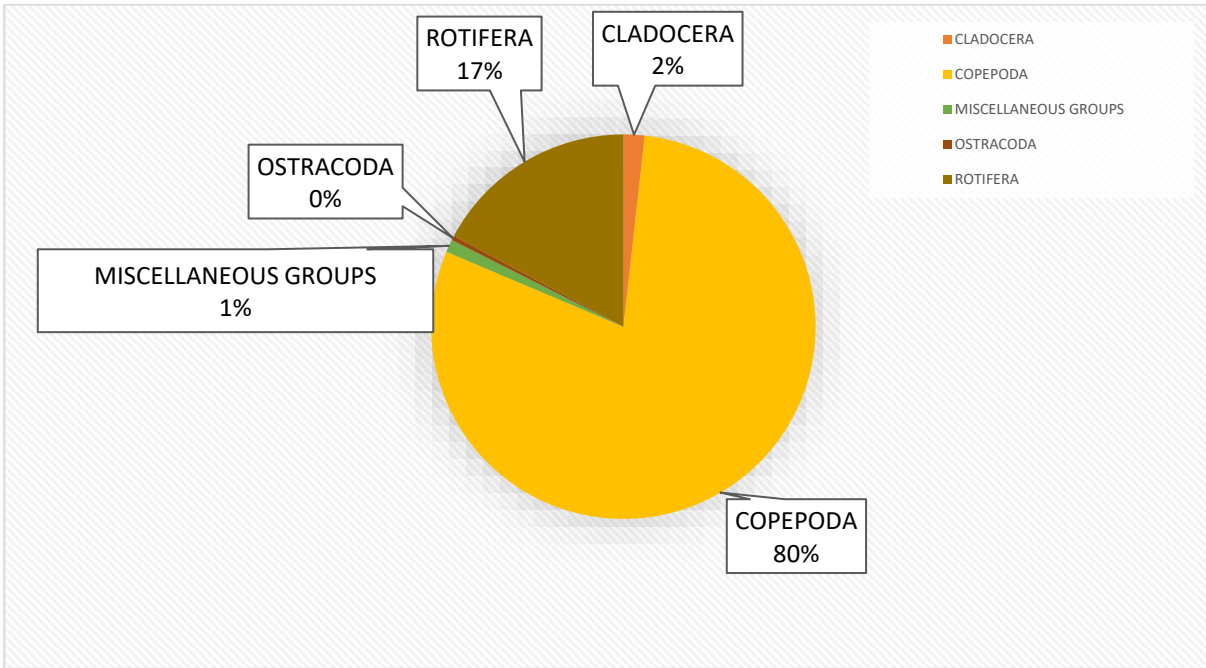


**Fig. (6): Percentage of the monthly abundance of zooplankton at stations 1 and 2, in the Shatt Al-Arab River during July-November 2018.**

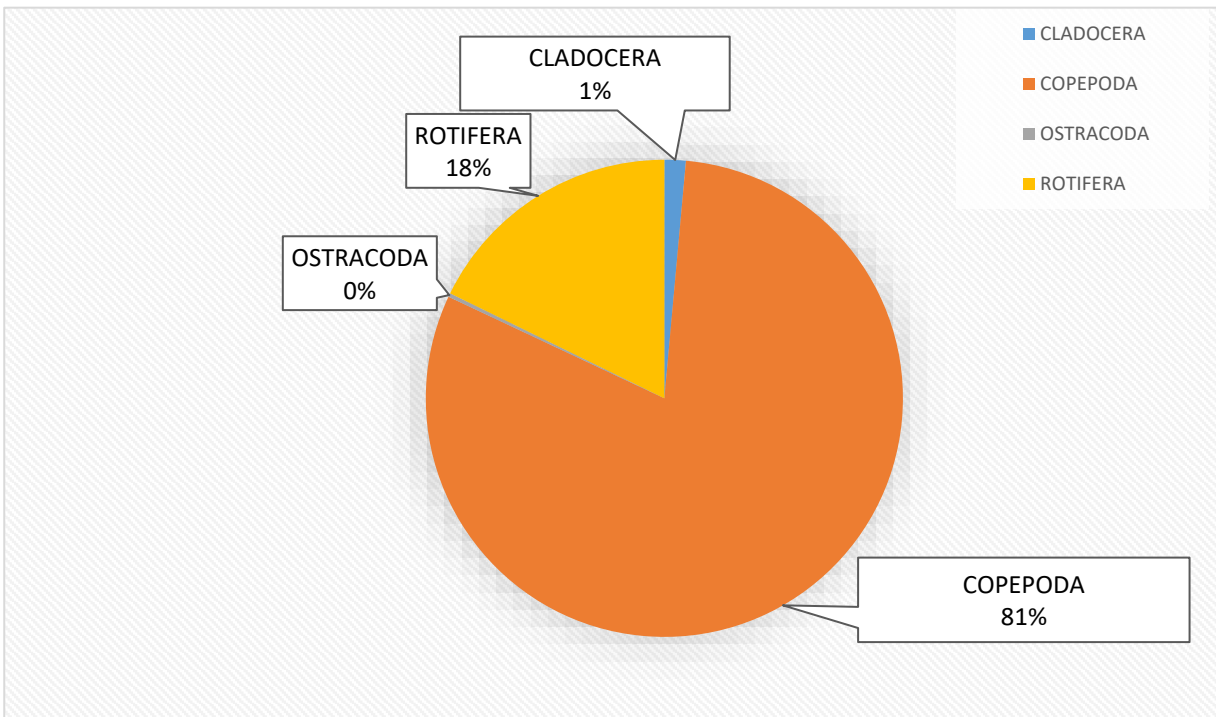
Copepoda was most abundant group of zooplankton at two stations during the study period followed by Rotifera (Figs. 7 and 8).

### Statistical Analysis

Significant correlations were found between environmental factors and some species, but the differences between the two stations were not significant.



**Fig. (7):** Percentage of zooplankton groups at the first station during July-November 2018.



**Fig. (8):** Percentage of zooplankton at the second station during July-November 2018.

**Table (1): List of the zooplankton species and density (ind.l<sup>-1</sup>) at stations 1 and 2 in the Shatt Al-Arab river, during July- November 2018.**

Taxa	July		August		September		October		November	
	St. 1	St. 2	St. 1	St. 2	St. 1	St. 2	St. 1	St. 2	St. 1	St. 2
CLADOCERA										
Cladocera	-			0.06				1.45		0.25
<i>Daphnia cephalata</i>	0.13		-		-		1.005		-	
<b>Total of Cladocera</b>	0.13			0.06			1.005	1.45		0.25
COPEPODA										
<i>Acanthocyclops americanus</i>	1.13		-		-		-		-	
<i>Acartia pacifica</i>								0.38		
<i>Acrocalanus gibber</i>	0.99	0.38	-	0.25	-	0.13	-	0.38	-	0.06
<i>Calanoid</i>	-						10.13	17.29	0.13	1.13
<i>Cryptocyclops</i>	0.25								-	
<i>Cyclopid</i>	-		0.06	0.06	1.68	2.08	19.81	16.85	2.83	15.22
<i>Cyclops vicinus</i>	-		-		-	0.88	5.41	2.26	-	0.79
Copepoda eggs	-		-		-		9.31	6.48	7.48	23.7
<i>Epactophanes riehardi</i>	-		-		-		0.31	0.06	0.06	
<i>Labidocera</i> sp.	-		-		-		0.25		-	
<i>Microsetella</i> sp.	-		-		-		1.006	0.38	0.06	

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Nauplius	0.94	2.77	0.06	0.63	21.001	20.94	42.001	25.65	2.77	25.53
<i>Paracyclops fimbriatus</i>	0.19		–		–		–		–	
<b>Total of Copepoda</b>	3.5	3.15	0.12	0.94	22.681	24.03	88.227	69.73	13.33	66.43
miscellaneous groups										
<i>chironomid pupu</i>	0.5		0.06		–		–		–	
Protozoa	–		0.13		–		–		–	
<b>Total of Miscellaneous groups</b>	0.5		0.19							
OSTRACODA										
<i>Chrissia Sp.</i>								0.06		
<i>Cypria javana</i>	0.06		–		–		–		–	
<i>Darwinula lundi</i>				0.06						
<i>Heterocypris Makua</i>										0.13
<i>Heterocypris sp.</i>	0.06		–		–		–		–	
<b>Total of Ostracoda</b>	0.12			0.12				0.06		0.13
ROTIFERA										
<i>Biachionus calyciflorus</i>						2.01				
<i>Brachionus budapestinensis</i>								0.13		
<i>Brachionus angularis</i>						0.94				
<i>Brachionus quadridentans</i>						0.06				
<i>Bedelloid</i>	-		-		0.19		-		-	
<i>Brachionus sp.</i>	-		–		2.52		0.06		-	
<i>Conochilus unicornis</i>	-		-		-		1.26		-	



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Rotifera eggs	0.19	0.38	–	0.06	5.09	13.46	10.94	11.76	1.32	7.42
<i>Lecane</i> sp.	-		-		0.13		-		–	
<i>Synchaeta lakowitziana</i>	-		–		0.13				8.61	13.02
<i>Trichocerca. rousseleti</i>	-		-		0.06		-		–	
<i>T. cylindrical</i>	-		-		0.19		-		-	
Total of Rotifera	0.19	0.38		0.06	8.31	16.47	12.26	11.89	9.93	20.44
Total of zooplankton	4.44	3.53	0.31	1.18	30.99	40.5	101.49	83.13	23.26	87

## Discussion

It is difficult to know the distribution of zooplankton. Its depending on the location because it is quick to influence environmental changes, so its density changes seasonally and spatially, because the distribution in the environment is usually in the form of clusters (patchiness) While the yield of nets varies from place to another (Raymont, 1983). The size of the mesh of nets used in the collection of samples has a significant influence on the quality and quantity of zooplankton (Ajeel, 1990).

The highest density recorded at (12.26) ind. l<sup>-1</sup> at the first station and the highest density at the second station (20.44) ind. l<sup>-1</sup> was significantly lower than the value recorded by Hammadi (2010) which reached (650.99) ind. l<sup>-1</sup> when studying for the Shatt Al-Arab region. Rabee (2007) records density (0.033) ind. l<sup>-1</sup> is much lower than the current study which indicated that the highest density recorded in the second station may be caused by a heavy presence of phytoplankton, which is food for zooplankton, this result agrees with study of Ajeel *et al.* (2004), there were correlations between the environmental factors and species through the use of SPSS analysis, as the relationship between temperature and *Synchaeta lakowitziana* and Rotifera eggs.

High temperature leads to the decomposition of organic matter and increased activity of microorganisms. Water temperature values showed clear monthly changes due to variations in the intensity of the sun's brightness, the length of daily light duration, the clarity of the sky and the season (Alkam & Abdel Moneim, 2011). The pH values were within the alkaline direction in the two study stations, the slight difference is due to the regulatory capacity of free carbon

dioxide and that's consistent with Attee's study (2004). The relative rise of pH is due to the dominance of bicarbonate, this consistent with the study of Lefta *et al.* (2010) on the Kufa River and study of Hussein *et al.* (2013) in the Shatt Al-Arab river, the decline is due to the biodegradation of organic materials, as noted by Al-Ghalbi *et al.* (2013) in his study of some of the physical and chemical properties of the Euphrates river water in the city of Nasiriyah, where he recorded a positive, non-significant correlation between pH and Cladocera.

The current study confirms the presence of zooplankton in a few numbers and this reflects the low secondary productivity of the river, that the lack of numbers due to environmental factors, especially salinity and their impact on each other, During the months of research, copepoda was increased with a decrease in the number of Cladocera. This is due to many reasons, including the fact that some of the Copepoda feed on small Cladocera (Marazzo & Valentin, 2004). The number of species may be different during the year for several reasons, such different times of growth, reproduction and spawning (Boxshal & De Faye, 2008), or it depends on the temperature, sometimes the relationship between it and the diversity of neighborhoods is inverse (Saygi *et al.*, 2011). That is, some species have a positive relationship with the temperature to some extent, temperature, pH and salinity have a significant role in the spread, distribution, density and presence of zooplankton (Dias & Bonecker, 2007). the reasons for the low presence of zooplankton is due to the high salinity values recorded in this study as mentioned (Nielson *et al.*, 2003) that salinity leads to the reduction of zooplankton as pollution tends to reduce the diversity of Al-Jizani (2005).

The reason for the existence of the naupli during all the period of the study is that they are larvae of different species, no significant relationship between salinity and nauplii taxa (Bedelloid, *Brachionus* sp., *Lecane* sp.) as well as the genus *Cyclopos* are the most successful and prevalent in the copepod group. It recorded no significant relationship between salinity and the genus of *Cyclops*. They form the basic aggregates of zooplankton, the reason for their success is due to tolerance the different conditions (Salva, 2008). Rotifera is a biological evidence of salinity, undernourishment and basal evidence and is rarely subject to geographical barriers, *Brachionus*, for example, is found in undernourished lakes (Yildiz *et al.*, 2010).

## Conclusions

The current study was recorded 34 taxa of zooplankton. The high densities of the larval stages of the copepod have led to dominance of the copepod over the rest of the zooplankton due to changes in environmental factors especially salinity.

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