

## Distribution and Abundance of Rotifers in the River Nile, Egypt

<sup>1</sup>Faten A. Elfeky and <sup>2</sup>Nehad K. Sayed

<sup>1</sup>Faculty of Science, Girls Branch Al-Azhar University, Cairo, Egypt

<sup>2</sup>National Institute of Oceanography and Fisheries, El Qanater Elkairia, Cairo, Egypt

**Abstract:** Rotifers are one of the most important groups of fresh water zooplankton in Egypt. A total of 56 species were recorded in the River Nile belonging to 25 genera which identified from 28 water samples collected seasonally in 2009 from 28 stations along the River Nile from Chema in the south to Faraskour in the north. The most dominant rotifer fauna was the planktonic genera, *Keratella*, *Brachionus*, *Polyarthra*, *Conchilus*, *Synchaeta*, *Collotheca*, *Philodina*, *Filina*, *Asplanchna* and *Anuraeopsis*. Rotifers were distributed along the River Nile with different density, increased toward the downstream of the river. Rotifer recorded the maximum number (1569000 organisms/m<sup>3</sup>) in autumn season followed by (10031000 organisms/m<sup>3</sup>), (9849000 organisms/m<sup>3</sup>) and (6763666.67 organisms/m<sup>3</sup>) in spring, winter and summer respectively.

**Key words:** Rotifers • Distribution • Abundance • River Nile

### INTRODUCTION

Rivers often contain an abundance of plankton, even though these organisms lack the ability to swim against currents [1-3]. Factors that influence the abundance of plankton in rivers fall generally into two categories: factors affect transport of organisms from source areas to the river and factors affect growth and reproduction of organisms in the river [1]. Zooplankton plays a key role in aquatic food chain. Owing to this they have attracted the attention of researchers throughout the world [4, 5].

Rotifers are highly nutritious food for the larvae of aquatic crustaceans and fish. Rotifers have complex diversity and distributions in fresh water because many species are cosmopolitan [6]. The distribution of Rotifera in River Nile is represented by 11 and 16 species [7]. 28 species belonging to 16 genera of Rotifers in Rosetta branch of Nile [8]. The impact of industrial wastes at Helwan on the River Nile zooplankton was studied; Rotifers formed about 85% of the total zooplankton [9].

Rotifera is the second dominant group of plankton in Rosetta Nile Branch and the abundance rate for it ranged between 10 to 20% of the total zooplankton count [10]. The presence of two zooplankton categories in area extending for 805 km on the Nile River during 1991 and Rotifers recorded as the dominant zooplankton group in the Damietta branch of the River Nile [11].

Zooplankton in some polluted areas of the River Nile was studied where it composed of four main groups and Rotifera contributed 56.31% [12].

Rotifera predominated over the other zooplankton groups and contributed about 47% and 42.3% to the total zooplankton community at the surface and subsurface layer of the Rosetta branch in River Nile [13]. The present study aimed to examine the species composition and the seasonal variation in Rotifera community along the River Nile.

### MATERIALS AND METHODES

**Collection of Samples:** Samples were taken seasonally from surface water from each station and thirty liters of each water sample were filtered through a zooplankton net of 55µm mesh diameter. Each collected sample was transferred to a labeled clean bottle and fixed into 4 % formaldehyde. Rose Bengal was added to facilitate separation of organisms from the suspended matter.

Sub samples of 1 ml were drawn from the sample (after careful mixing) using a wide-pipette [14]. The contents of such pipette were let to flow freely into 1 ml Sedgwick-Rafter cell. Three successive sub samples were examined under a binocular compound microscope at 10x magnification. Identification of various taxa was based on the works of [15-17].



Fig. 1: A space Map of the River Nile and the sampling sites

**Site Description:** The study area extends from Aswan to Cairo through 28 stations which illustrated in the space map of the River Nile (Fig. 1).

## RESULTS

The data in Table (1) represented the abundance of Rotifer species during the study period (from winter 2009 to autumn 2009) in River Nile and its branches.

During autumn season, the total number of rotifers was  $15690000 \text{ ind/m}^3$  with an average  $560357.1 \pm 127544.23$ . In the main body of river, rotifer increased downstream from Naga Hammadi to El-Waraq except Ghamaza El-Kobra which recorded the minimum number  $666.6667 \text{ ind/m}^3$ . This minimum value also recorded at Etsa 1, El-Hawamdia 1 in the upstream region. While, the highest value ( $2399000 \text{ ind/m}^3$ ) recorded at El-Hawamdia 2.

At Rosetta branch, there was a remarkable increasing at the last three stations Kafer El-Zayat, Desouk and Fuwa. On the other hand, Rotifera showed decreasing in Damietta branch except Faraskour station.

In winter Rotifera was recorded total number of individuals  $9849000.00 \text{ ind/m}^3$  with an average  $351750 \text{ Ind/m}^3 \pm 63032.43$ . Where, it recorded the minimum number in the upstream region  $15333.33 \text{ ind/m}^3$  at Com Ombo1 station .while, rotifera increased toward the downstream of the river recording the maximum value  $1070000 \text{ Ind/m}^3$  at Faraskour station. In El-Rahawy 2- Tamalay- Kafer El-Zayat-Talkha and El-Serw stations Rotifera was showed a remarkably decreasing in number. In spring season.

Rotifera was recorded a total number  $10031000 \text{ Ind/m}^3$  with an average  $358250 \text{ ind/m}^3 \pm 79164.12$ . And have the same pattern of abundance as a total number of

Table 1: The number of Rotifers collected from each survey station during different seasons

Stations	Autumn	Winter	Spring	Summer
Chema 1	31000	25666.67	82333.333	3333.3333
Chema 2	666.67	23000	76000	5000
Com Ombo 2	12000	24000	86000	0
Com Ombo 1	34000	15333.33	50000	7000
Luxor	666.67	30000	106000	38666.667
Qus 1	104666.67	62333.33	52666.667	4333.3333
Qus 2	102666.67	32333.33	57000	290666.67
N. Hammadi	388000	188666.67	72000	16666.667
Assiut	390000	428000	82000	43666.667
Etsa 1	1738000	776666.67	115333.33	44666.667
Etsa 2	941000	574000	82666.667	144666.67
G.El-Kobra	666.67	702000	289333.33	0
El-Hawamdia 1	2069333.3	498333.33	140000	196666.67
El-Hawamdia 2	2399000	606000	160666.67	248666.67
S.El-Khiema	1097333.3	502000	412000	529666.67
El-Waraq	1025333.3	341333.33	264000	528000
El-Rahawy 2	79333.33	85333.33	136000	269000
El-Rahawy 1	226000	232666.67	443333.33	508666.67
Benha	217333.33	758666.67	425000	501333.33
Tamalay	177000	85333.33	360666.67	312000
Com Hamada	190000	642666.67	556666.67	261666.67
Zefta	132666.67	207666.67	808333.33	700666.67
Kafer El-Zayat	855333.33	109333.33	802000	798000
Talkha	55333.33	68000	137666.67	38333.333
Desouk	998666.67	1041000	1680000	191333.33
Fuwa	1352000	697000	1439333.3	62333.333
El-Serw	189000	21666.67	221333.33	99333.333
Faraskour	883000	1070000	892666.67	919333.33
Sum	15690000	9849000	10031000	6763667
Average	560357.1± 12754423	351750± 63032.43	358250± 79164.12	260141.03± 52396.77

zooplankton in this season where it increased from Ghamaza El-Kobra toward the downstream recording the maximum value 1680000 ind/m<sup>3</sup> at Desouk station except El-Hawamdia 1&2 – El-Rahawy 2 – Talkha and the El-Serw stations while, decreased in the upstream of the river recording the minimum value 50000 Ind/m<sup>3</sup> at Com Ombo 1 station.

During summer season, Rotifera was recoded a total number 6763666.67 ind/m<sup>3</sup> with an average 260141.03 ind/m<sup>3</sup> ±52396.77.while, increased from Qus2 station toward the downstream of the river recording the maximum number (919333.33 ind/ m<sup>3</sup>) at Faraskour station except Naga Hamadi – Assiut- Etsa 1 - Ghamaza El-Kobra – Talkha – Fuwa and El-Serw stations.in contrast, rotifera was decreased in upstream region and recording the minimum number at the First station (Chema 1)3333.33 ind/m<sup>3</sup>.

**The Dominancy of Rotefira:** The data in Table (2), plates1,2,3,4,5,6 and 7 indicate that *Keratella cochlearis*

was the most dominant rotifer species appeared along the River Nile and its branches represent 33.32% to the total rotifer with total number 14105333.33 ind/m<sup>3</sup>.the species appeared during all seasons in the year and covered all stations in spring and winter seasons. While, recorded the highest percent at autumn season which represent 44.08% of total rotifer in this season.

*Brachionus calyciflorus* was the second important rotifer species in the study area. It forms 15.1% to the total rotifer with total number 6393666.67ind/m<sup>3</sup>.The species recorded the maximum percent in winter season 19.25% of total rotifer in this season. Where, it covered 26 stations in winter season while in spring, summer and autumn seasons it was absent in the upstream of the river.

*Polyarthra vulgaris* was detected 5.98% to the total rotifer with total number 2532000 ind/m<sup>3</sup>. this species was absent in the upstream of the river in all seasons of year and increased toward the downstream where covered about 20 stations and recorded 10.49% of total rotifer in summer season as maximum percent.

*Conchilus unicornis* was the next dominant species which represented 5.5% to the total rotifer with total number 2329000 ind/m<sup>3</sup>. The species appeared in all season of year and covered most of stations of river except in summer and winter seasons it was absent in the upstream region. While, recorded the highest percent 11.96% of rotifer in winter season.

*Synchaeta pectinata* recorded 4.43 % of the total rotifer with total number 1876000 ind/m<sup>3</sup>. The species covered 23 stations in winter season and represented 9.26 % of rotifer as high percent. While, it was absent in the upstream in autumn and summer seasons.

*Keratella tropica* was the second species of genus Keratella which represented 4.32% of the total rotifer with total number 1829333.33 ind/m<sup>3</sup>.Tthis species were found along the River Nile in winter, spring and autumn seasons recorded the maximum value 6.48% in autumn season. While, it decreased in River Nile in summer season and increased in branches.

*Collotheca ornate* recorded a percentage of 4.32% to the total rotifer with total number 1828333.33 ind/m<sup>3</sup>. It distributed along the River Nile and its branches while, this species in spring season, covered all stations and recorded the highest percentage 8.07% in summer season. *B. caudatus* represented 4.42% of the total rotifer with total number 1871000ind/m<sup>3</sup>. This species was absent or decreased in the upstream region in all seasons. While, it increased towards the downstream and covered about 20 stations in spring season represented 12.58% of rotifer in this season.

Table 2: The number of individuals/m<sup>3</sup> of the most dominant species of Rotifera in River Nile and its branches Rosetta and Damietta from winter 2009 to autumn 2009

Species	Total number of species	% to the group	The highest % in seasons
<i>Keratella cochlearis</i>	14105333.33	33.32	Autumn 44.08
<i>Brachionus calyciflorus</i>	6393666.67	15.1	Winter 19.25
<i>Polyarthra vulgaris</i>	2532000	5.98	Summer 10.49
<i>Conchilus unicornis</i>	2329000	5.5	Winter 11.96
<i>Synchaeta pectinata</i>	1876000	4.43	Winter 9.26
<i>K. tropica</i>	1829333.33	4.32	Autumn 6.48
<i>Collotheca ornata</i>	1828333.33	4.32	Summer 8.07
<i>B. caudatus</i>	1871000	4.42	Spring 12.58
<i>Polyarthra euryptera</i>	1566333.33	3.7	Spring 4.66
<i>Philodina roseola</i>	1312000	3.1	Summer 7.55
<i>Filina longiseta</i>	1249000	2.95	Winter 6.29
<i>Asplanchna priodonta</i>	1040333.33	2.46	Spring 3.67
<i>Anuraeopsis fissa</i>	536000	1.27	Summer 5.27
<i>B. quadridentatus</i>	468000	1.11	Summer 3.22

*Polyarthra euryptera* recorded 3.7% of the total rotifer with total number 1566333.33 ind/m<sup>3</sup>. The species was absent in the upstream of river and covered about 18 stations in autumn, spring and summer seasons and covered 21 stations in winter season while, it recorded the maximum percent 4.66% of rotifer in spring season.

*Philodina roseola* was detected by 3.1% of the total rotifer with total number 1312000 ind/m<sup>3</sup>. It was distributed along the river in all seasons of year covered 24 to 26 stations and recorded 7.55% of rotifer in summer season as maximum percent.

*Filina longiseta* was represented by 2.95% of the total rotifer in the study with total number 1249000 ind/m<sup>3</sup>. It increased towards the downstream of the river in all seasons and recorded the highest percent 6.29% of rotifer in winter season.

*Asplanchna priodonta* recorded 2.46% of total rotifer with total number 1040333.33 ind/m<sup>3</sup>. This species increased in Rosetta and Damietta branches while, it decreased in the main body of the river and was absent completely in the upstream in autumn and summer seasons.

*Anuraeopsis fissa* recorded 1.27% of total rotifer in study with total number 536000 ind/m<sup>3</sup>. The species decreased in the autumn and winter seasons. While, increased in spring and summer seasons and recorded the maximum percent 5.27% of rotifer in summer season.

*B. quadridentatus* represented 1.11% of total rotifer with total number 468000 ind/m<sup>3</sup>. The species distributed along the river and increased towards the downstream recorded the maximum percent 3.22% of rotifer in summer season.

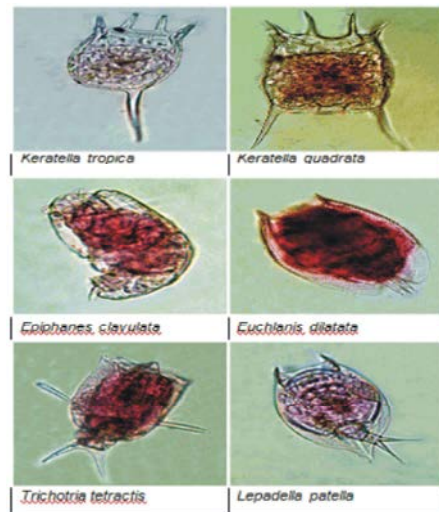


Plate (1)

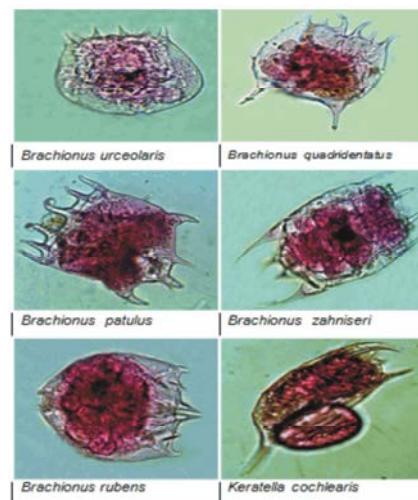


Plate (2)

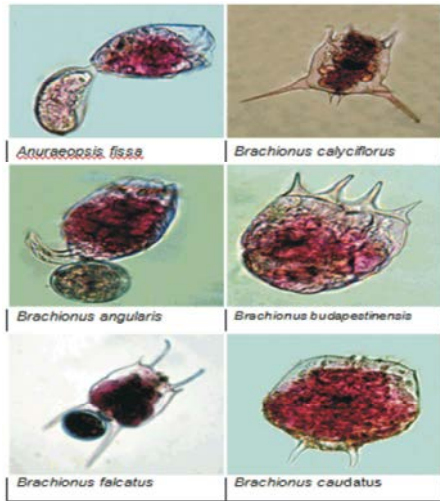


Plate (3)

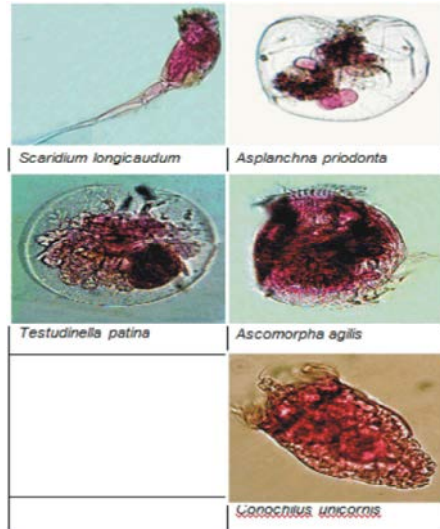


Plate (4)

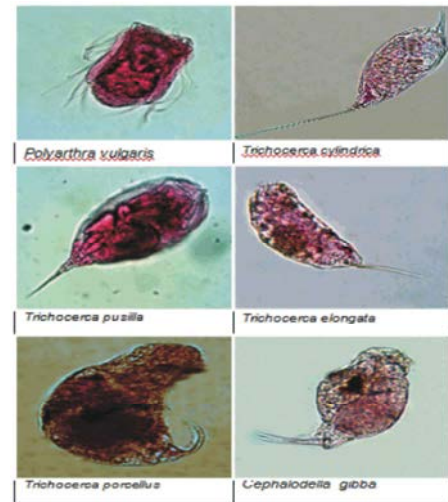


Plate (5)

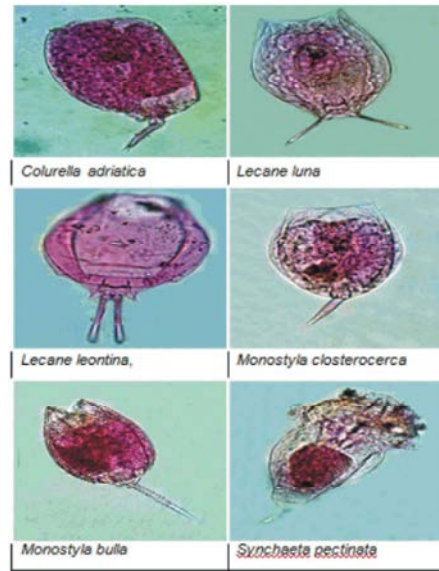


Plate (6)

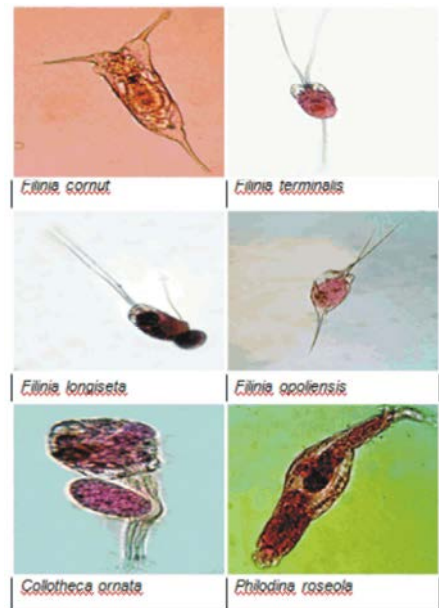


Plate (7)

## DISCUSSION

Zooplankton may form an important component of the biological communities in River Nile as a large river due to their high abundances and their ability to cycle nutrients through the aquatic environment. Rotifers were the dominant zooplankton in River Nile and they also the dominant in the Waikato River in New Zealand [18]. Factors that influence the abundance of plankton in rivers fall generally into two categories: factors affecting transport of organisms from source areas to the river and

factors affecting growth and reproduction of organisms in the river [1]. The hatching of resting eggs in river sediments may also facilitate the development of zooplankton populations in rivers [19].

Throughout the present investigation the density of Rotifer along the River Nile decreased upstream and increased downstream implying that the populations are able to reproduce [20]. However, increases may vary seasonally with flow or may not occur at all [1]. The flood pulse acts as a driving force and stressing condition, rotifer community dynamics, either changing species composition or decreasing abundance [21].

The maximum density was detected in autumn, followed by spring then winter and the lowest density was in summer. This result indicated that Rotifers prefer the moderate temperature of autumn and spring.

The results of the study of Nagwa *et al.* [13] showed that a maximum density of Rotifer in Rosetta Estuary of The River Nile Egypt was observed during December and appeared at low density during March.

The most dominant rotifer fauna in this study was the planktonic genera *Keratella*, *Brachionus*, *Polyarthra*, *Conchilus*, *Synchaeta*, *Collotheca*, *Philodina*, *Filina*, *Asplanchna* and *Anuraeopsis*.

These results are in agreement with [13]. In temple ponds of Nashik District, India 17 genera recorded from rotifer and genus *Brachionus* is abundant and more common [22]. The presence of *Brachionus* species, *Keratella cochlearis* and *Filinia* species in any water body is an indicator of eutrophy [23], while *Filinia longiseta* was considered among pollution indicators [24].

Planktonic rotifer communities in the freshwater parts of estuaries are often numerically dominated by members of the genera *Keratella* and *Brachionus* [25-27], where species of the genus *Synchaeta* are often dominated in the brackish water regions [28-31].

Throughout the present investigation, *Keratella cochlearis* was the most dominant Rotifer species appeared along the River Nile and its branches, its maximum percent was in autumn season. *Brachionus calyciflorus* was the second important Rotifer species recorded the maximum percent in winter and was absent in the other seasons.

*Polyarthra vulgaris* was absent in the upstream of the river in all seasons of the year and increased toward the downstream and recorded maximum percent in summer.

*Conchilus unicornis* was the next dominant species which was absent in the upstream region and recorded the highest percent in winter season.

*Keratella cochlearis* was the most dominant species followed by *Brachionus urceolaris* and *Brachionus calyciflorus* in Rosetta Estuary of the River Nile, Egypt [13]. Change in species composition and abundance was found in the Rosetta Branch of the Nile River, where *Hexarthra mira* represented the dominant Rotifer, followed by *Brachionus urceolaris*, *Brachionus urceolaris* and *Brachionus calyciflorus* respectively [32].

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