

Diversity of Zooplanktons and Their Seasonal Variation of Density in Gulabsagar Water Body, Jodhpur (Rajasthan) During 2014-2016

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Abstract: *The present paper deals with the study of diversity of Zooplanktons and their seasonal variation of density in the GulabSagar water body, Jodhpur. Samples were collected for a period of two years (May 2014-April 2016) at each month and collected samples were evaluated for the study of Zooplankton. In the present study the zooplanktons consisted of Rotifers, Ostracods, Cladocerans and Copepoda. The quantitative estimation shows that in both the yearsof study (2014 – 2015 and 2015 – 16) the Rotiferans dominated in the population while other wereencountered with moderate number.The study also reveals that during seasonal variation the Rotiferans dominated mainly in the winter season in both the years of study which can be due to favourable temperature and availability of abundance of food material. In the present study the Zooplanktons were represented by 41 species and consisted of Rotifera (15), Cladocera (21), Copepoda (4) and ostracoda (1). The quantitative relationship among different groups of Zooplanktons during year (2014 – 2015) was Rotifera>Copepoda>Cladocera>Ostracoda. During the year (2015 – 2016) the above relationship was Rotifera>Copepoda>Cladocera>Ostracoda.*

Keywords: *GulabSagar water lake, Zooplankton, Rotifera, Cladocera, Copepoda, Ostracoda.*

1. INTRODUCTION

Biodiversity is a variety of life which includes different genes, species, communities and ecosystems. Rich diversity of organisms in an aquatic ecosystem reflects good water quality and any change in water quality due to the addition of pollutants affects diversity and abundance of organisms. Biological parameters includes collection, preservation, identification, qualitative and quantitative enumeration of Zooplankton.

Zooplankton are animals suspended in water with limited of locomotion .They graze heavily on algae, bacteria and suspended detritus. The Zooplanktons are microscopic free living organisms which occupy a central position between the autotrophs and other heterotrophs and form an important link in aquatic food webs. They constitute an important component of secondary production in aquatic ecosystems and play a vital role in the energy allocation in different trophic levels. The knowledge of their seasonal qualitative and qualitative estimation has been considered essential for proper manipulation of the factors influencing biological productivity of the water body.

2. STUDY AREA

Jodhpur district is situated between 25°51'08" & 27°03'09" North latitude and 71°48'09" & 73°05'06" East longitude covering geographical area of 22,850 sq km. This district comes under arid zone of the Rajasthan State. Jodhpur district is part of Jodhpur Division. The district is divided into 5 sub-divisions namely Jodhpur, Shergarh, Pipar City, Osian & Phalodi and comprises of 07 tehsils & 09 blocks. Total number of villages in the district is 1157.GulabSagar Lake is located about 6kms from Jodhpur city center near Sardar Market in old city area (23°03' and 30°12' N latitude and 69°03' and 78°07' E longitude). Measuring 150x90m in size with the capacity of 4.48m cusecs of water. GulabSagar Lake is actually a water storage constructed in 1788 by Gulab Rai, the mistress of Maharaja Vijay Singh. Earlier the place was occupied with another water source called 'Bawri', which was converted into Gulab Sagar. It took around 8 years for completing the construction of Gulab Sagar. The lake gets water through a canal from Bal Samand Lake (Fig.1).



Fig1. Gulab Sagar Lake of Jodhpur

3. ANALYSIS OF WATER SAMPLE

Water samples were collected in polythene bottles of two litres capacity once in a month, from the different sites of GulabSagar water body for a period of two years (May 2014 to April 2016) .These collected samples were than preserved in Refrigerator and Analysis of water was done. The recorded data was divided into mainly three seasons:

1. Summer season (February to May)
2. Monsoon season (June to September)
3. Winter season (October to January)

4. MATERIALS AND METHODS

Zooplankton collection was done by filtering 100 litres of water sample through Plankton net number 25made up of Nylon bolting silk cloth having small mesh size approximately 64μ at monthly intervals, during the period of investigation .These Zooplankton samples were collected in 50 ml bottle and preserved in 4% formalin.

Quantitatively Zooplanktons were enumerated by Sedgwick Rafter Cell method and results were expressed as :

$$\text{No. of Zooplankton / ltr.} = (A \times 1000) \times C / V$$

Where ,

A = No. of Zooplankton in 1 ml. of sample .

C = Volume of concentrate in ml.

V = Volume of sample filter in litre.

5. RESULT AND DISCUSSION

In the present study the zooplanktons consisted of Rotifers, Ostracods, Cladocerans and Copepoda. The quantitative estimation shows that in both the years of study (2014 – 15 and 2015 – 16) the Rotiferans dominated in the population while other wereen countered with moderate number. The study also reveals that during seasonal variation the Rotiferans dominated mainly in the winter season in both the years of study which can be due to favourable temperature and availability of abundance of food material. The Ostracoda was dominated during summer in both the years of study. The Cladocerans were found more in winter season. They also play an important role in the benthic dynamics.

In the present study the Copepods were maximum during summer season in both the years of study. In the present study the Zooplanktons were represented by 41 species and consisted of Rotifera (15), Cladocera (21), Copepoda (4) and ostracoda (1). The quantitative relationship among different groups of Zooplanktons during year (2014 – 2015) was Rotifera>Copepoda>Cladocera>Ostracoda. During

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the year (2015 – 2016) the above relationship was Rotifera>Copepoda>Cladocera> Ostracoda. The Rotifera was represented by *Brachionus Calyciflorus*, *B. diversicornis*, *B. quadridentatus*, *B. falcatus*, *B. caudatus*, *Plationus patulus*, *Keratellatropica*, *Lecanodectipice*, *L. cornuta*, *L. ohioensis*, *L. monostyla*, *Horellabrehmi*, *Asplanchnabrightwelli*, *Trichocerca* spp., *Testudinella* spp.

The Cladocera was represented by *Diaphanosomasarsi*, *D. senegal*, *D. excisum*, *Ceriodaphnia Cornuta*, *C. laticaudata*, *C. quadragula*, *C. pulchella*, *Bosminalongirostris*, *Moinamicrura*, *Macrothrixgeoldii*, *M. laticornis*, *Chydorussphaericus*, *Echiniscatriserialis*, *E. odiosa*, *Pluroxusaduncus*, *Alonarectangulararectangula*, *Alonarectangularrichardi*, *Alonadavidipunctata*, *Alonella* spp., *Camptocerus* spp., *Simocephalus* spp.

The Copepoda was represented by *Cyclops* spp., *Mesocyclop* spp., *Eucyclop* spp. and *Diaptomus* spp. The Ostracoda was represented by only one species of *Cypris*.

5.1. Relative Abundance

The relative data of Zooplankton were shown in Tables 1, 2, 3, 4 and Graph 1, 2.

The Zooplanktons consisted of Rotifers, Ostracods, Cladocerans and Copepods. Total 730 Ind/l Zooplanktons were recorded during the year 2014 – 2015 and 844 Ind/l in the year 2015 –2016. In the Rotifera among the different species during the year 2014 – 2015 *Brachionusfalcatus* (55 Ind/l) dominated, followed by *Keratellatropica* (43Ind/l), *Asplanchnabrightwelli* (22 Ind/l) and *Horellabrehmi* (2 Ind/l).

During the year 2015 –2016, *B. falcatus* (101 Ind/l) was dominated, followed by *B. calyciflorus* (57Ind/l), *B. diversicornis* (14 Ind/l), *Lecanemonostyla* (14 Ind/l) and the least appearance was shown by *Lecaneohioensis* (2 Ind/l)

During the year 2014 –2015 the total number of Ostracoda was recorded as 75 Ind/l which contributed 10% where as during the year 2015 –2016 it was recorded 94 Ind/l contributing 11% of Zooplanktons.

During the year 2014 –2015 Cladocera was recorded as 199Ind/l contributing 21% and during the year 2015 –2016 as 209 Ind/l contributing 25%. In Cladocera during the year 2014 –2015 among different species *Moinamicrura* (48 Ind/l) has shown its dominance followed by *Ceriodaphniacornuta* (38 Ind/l), *Alonadavidipunctata* (24Ind/l) and the least appearance was shown by *Echiniscaodiosa* (1Ind/l). During the year 2015 –2016 again *Moinamicrura* (43 Ind/l) shown its dominance followed by *C. cornuta* (39 Ind/l), *Diaphanosomasenegal* (30 Ind/l) and the least appearance was shown by *Alonellaspp* (1 Ind/l) and *Echiniscaodiosa* (1 Ind/l).

During the year 2014 –2015, Copepoda was recorded with 224 Ind/l that contribute to 32% and during the year 2015 –2016 with 257 Ind/l that contributed to 33% of the total Zooplankton. In Copepoda among the different species during the year 2014 –2015 *Diaptomus* spp. (99 Ind/l) was dominant and the least appearance was shown by *Eucyclop* spp. (15Ind/l) During the year 2015 –2016, *Cyclop* spp. (66 Ind/l), *Eucyclop* spp. (66 Ind/l) showed their dominance followed by *Mesocyclop* spp. (63 Ind/l) and *Diaptomus* spp. (62 Ind/l).

5.2. Seasonal Abundance

The maximum number of Zooplanktons were recorded with 396 Ind/l during the winter season of the year 2014 –2015 and minimum 93 Ind/l in monsoon during the year 2015 –2016. During the monsoon season of the year 2014 –2015, Rotifera contributed 39% , Ostracoda 19%, Cladocera 10% and Copepoda 32% where as during the year 2015 –2016, Rotifera contributed 30%, Ostracoda 23% , Cladocera 14% and Copepoda 33%.

During the winter season of the year 2014 –2015, Rotifera contributed 39%, Ostracoda 0%, Cladocera 43% and Copepoda 18% and in the year 2015 –2016 , Rotifera contributed 40% , Ostracoda 3%, Cladocera 36% and Copepoda 21%. During the summer season of the year 2014 –2015 , Rotifera contributed 23% , Ostracoda 18% , Cladocera 17% and Copepoda 42% and in the year 2015 –2016 , Rotifera contributed 28% , Ostracoda 17%, Cladocera 14% and Copepoda 40%. Rotiferans were recorded maximum with 157 Ind/l in the winter season of the year 2014 –2015 and minimum 36 Ind/l in the monsoon season of the year 2015 –2016 . It contributed maximum to the extent of 53% in the winter, followed by 32% in summer season and 15% in the monsoon season of the year 2014 –2015.

During the year 2015 –2016, Rotiferans dominated in the winter season by contributing 55% followed by 32% in the summer and 13% in the monsoon. Ostracoda were recorded maximum of 58 Ind/l in the

summer season of the year 2014 –2015 and minimum 10 Ind/l in the winter season of the year 2015 – 2016. Ostracoda was not recorded in the winter season of the year 2014 –2015. It contributed maximum to the extent of 77% in the summer season followed by 23% in the monsoon season of the year 2014 –2015.

During the year 2015 –2016 it dominated with 60% in the summer season followed by 30% in the monsoon season and 10% in the winter season. Cladocera were recorded with maximum of 144 Ind/l in the winter season of the year 2014 –2015 and minimum 10 Ind/l in the monsoon season of the year 2015 –2016. It contributed maximum of 69% in the winter season, followed by 26% in the summer season and 5% in the monsoon season of the year 2014 –2015. During the year 2015 –2016, it was dominated with 69% in the winter season, followed by 22% in the summer season and 9% in the monsoon season.

Copepoda were recorded maximum of 135 Ind/l in the summer season of the year 2014 –2015 and minimum of 30 Ind/l in the monsoon season of the same year. It contributed maximum of 60% in the summer season, followed by 26% in the winter season and 14% in the monsoon season. During the year 2015 –2016 it was dominated with 51% in the summer season, followed by 33% in the winter season and 16% in the monsoon season.

Table 1. Monthly variation of Zooplankton at GulabSagar water body, Jodhpur during year 2014-2015

	Zooplankton	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
S.NO.	ROTIFERA													
	Family:Brachionidae													
A	Brachionuscalyciflorus	0	4	0	0	0	2	5	8	0	0	0	0	19
1	Brachionusdiversicornis	0	4	0	0	8	2	0	0	0	0	5	0	19
2	Brachionusquadridentatus	0	2	0	0	0	1	0	3	0	0	2	1	9
3	Brachionuscaudatus	0	1	0	0	2	0	0	0	1	0	0	0	4
4	Brachionusfalcatus	5	2	0	0	0	0	7	10	7	3	11	10	55
5	Plationuspatulus	0	0	0	0	0	1	0	2	0	0	0	3	6
6	Keratellatropica	0	0	0	0	5	8	7	4	0	0	10	9	43
7	Family:Lecanidae													
B	Lecanedecepiens	0	0	0	0	3	6	0	0	1	0	0	0	10
8	Lecanecornuta	1	0	0	0	0	0	4	2	3	0	0	0	10
9	Lecaneohioensis	0	0	0	0	1	2	0	0	2	0	0	0	5
10	Lecanemonostyla	1	0	0	0	2	4	2	1	0	0	0	0	10
11	Family:Trichocercidae													
C	Trichocerca spp.	1	1	0	0	0	5	9	0	1	0	0	0	17
12	Family:Asplanchnidae													
D	Asplanchnabrightwelli	0	1	0	0	0	2	7	0	0	4	5	3	22
13	Family:Trochosphaeridae													
E	Horaellabrehami	0	0	0	0	0	0	0	2	0	0	0	0	2
14	Family:Testudinellidae													
F	Testudinella spp.	0	0	0	0	0	0	1	1	0	0	0	0	2
15	TOTAL=	8	15	0	0	21	33	42	33	15	7	33	26	233
	OSTRACODA													
	Cypris spp.	12	10	0	0	7	0	0	0	0	15	17	14	75
S.NO.	Zooplankton	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
	CLADOCERA													
A	Family:Sididae													
1	Diaphanosomasarsi	0	0	0	0	0	1	1	0	2	0	0	0	4
2	Diaphanosomaexcisum	0	0	0	0	0	0	0	2	1	1	0	0	4
3	Diaphanosomasenegal	0	0	0	0	0	0	0	0	3	1	0	0	4
B	Family:Daphnidae													
4	Ceridaphniacornuta	0	0	0	0	5	10	7	8	5	2	1	0	38
5	Ceridaphniaquadrangula	0	0	0	0	0	2	4	6	3	1	0	0	16
6	Ceridaphnialaticaudata	0	0	0	0	0	0	0	2	0	0	1	0	3
7	Ceridaphniapulchella	0	0	0	0	0	0	0	1	1	1	0	1	4
8	Simocephalus spp.	0	0	0	0	0	1	0	2	1	3	0	2	9
C	Family:Moinidae													
9	Moinamicrura	1	0	0	0	0	5	12	15	2	7	4	2	48
10	Bosminalongirostris	1	2	0	0	0	2	2	0	1	0	0	0	8

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D	Family:Macrothricidae													
11	Macrothrixgoeldii	0	0	0	0	0	2	2	1	2	1	0	0	8
12	Macrothrixlaticornis	0	0	0	0	0	1	1	1	2	0	0	0	5
13	Echiniscatriserialis	0	0	0	0	0	0	1	0	1	0	0	0	2
14	Echiniscaodiosa	0	0	0	0	0	0	0	1	0	0	0	0	1
E	Family:Chydoridae													
15	Chydorussphaericus	0	1	0	0	0	0	1	0	0	2	5	2	11
16	Pluroxusaduncus	0	0	0	0	0	0	0	1	0	0	0	0	1
17	Alonella spp.	0	0	0	0	0	0	0	0	0	0	0	0	0
18	Alonarectangularectangula	0	0	0	0	0	0	1	2	2	0	0	0	5
19	Alonarectangularichardi	0	0	0	0	0	0	0	1	0	2	1		4
20	Alonadavidipunctata	0	0	0	0	2	0	2	5	6	7	0	2	24
21	Camptocercus spp.	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL=	2	3	0	0	7	24	34	47	33	26	13	10	199
	COPEPODA													
22	Mesocyclop spp.	1	5	0	0	2	2	0	0	0	3	2	2	17
23	Eucyclop spp.	1	2	0	0	5	0	0	0	2	2	2	1	15
24	Cyclop spp.	18	5	0	0	0	7	2	10	5	0	22	24	93
25	Diaptomus spp.	15	0	0	0	11	8	10	8	5	12	19	11	99
	TOTAL=	35	12	0	0	18	17	12	18	12	17	45	38	224

Table2. Monthly variations of Zooplankton at GulabSagar water body, Jodhpur during year 2015-2016

S.No.	Zooplankton	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
	ROTIFERA													
A	Family:Brachionidae													
1	Brachionuscalyciflorus	0	6	0	0	0	3	12	19	10	5	2	0	57
2	Brachionusdiversicornis	0	2	0	0	0	5	4	0	2	1	0	0	14
3	Brachionusquandridentatus	0	1	0	0	3	0	5	3	0	0	1	0	13
4	Brachionuscaudatus	0	0	0	0	2	0	2	0	0	0	0	0	4
5	Brachionusfalcatus	8	2	0	0	1	2	5	10	19	25	17	12	101
6	Plationuspatulus	1	0	0	0	0	0	1	2	0	0	2	0	6
7	Keratellatropica	0	0	0	0	0	4	0	7	0	0	0	0	11
B	Family:Lecanidae													
8	Lecanedecepiens	1	0	0	0	0	2	0	4	0	0	0	2	9
9	Lecanecornuta	0	0	0	0	3	6	0	3	2	0	0	0	14
10	Lecaneohioensis	0	0	0	0	0	0	0	1	1	0	0	0	2
11	Lecanemonostyla	0	0	0	0	0	2	3	5	1	2	1	0	14
C	Family:Trichocercidae													
12	Trichocerca spp.	0	1	0	0	0	6	2	0	0	0	0	0	9
D	Family:Asplanchnidae													
13	Asplanchnabrightwelli	0	1	0	0	15	2	2	0	0	0	10	0	30
E	Family:Trochosphaeridae													
14	Horaellabrehmi	0	0	0	0	0	0	0	0	0	0	0	0	0
F	Family:Testudinellidae													
15	Testudinella spp.	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL=	10	13	0	0	24	32	36	54	35	33	33	14	284
	OSTRACODA													
1	Cypris spp.	11	10	0	0	18	10	0	0	0	10	15	20	94
S.NO.	Zooplankton	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
	CLADOCERA													
A	Family:Sididae													
1	Diaphanosomasarsi	1	1	0	0	1	4	3	0	0	0	2	2	14
2	Diaphanosomaexcisum	0	0	0	0	0	0	1	0	0	1	0	0	2
3	Diaphanosomasenegal	0	0	0	0	1	2	5	7	8	4	3	0	30
B	Family:Daphnidae													
4	Ceridaphniacornuta	1	0	0	0	2	8	10	6	5	3	2	2	39
5	Ceridaphniaquadrangula	0	0	0	0	0	3	2	5	1	0	0	0	11
6	Ceridaphnialaticaudata	0	0	0	0	1	0	1	0	0	0	0	0	2
7	Ceridaphniapulchella	0	1	0	0	2	0	0	3	1	0	0	0	7

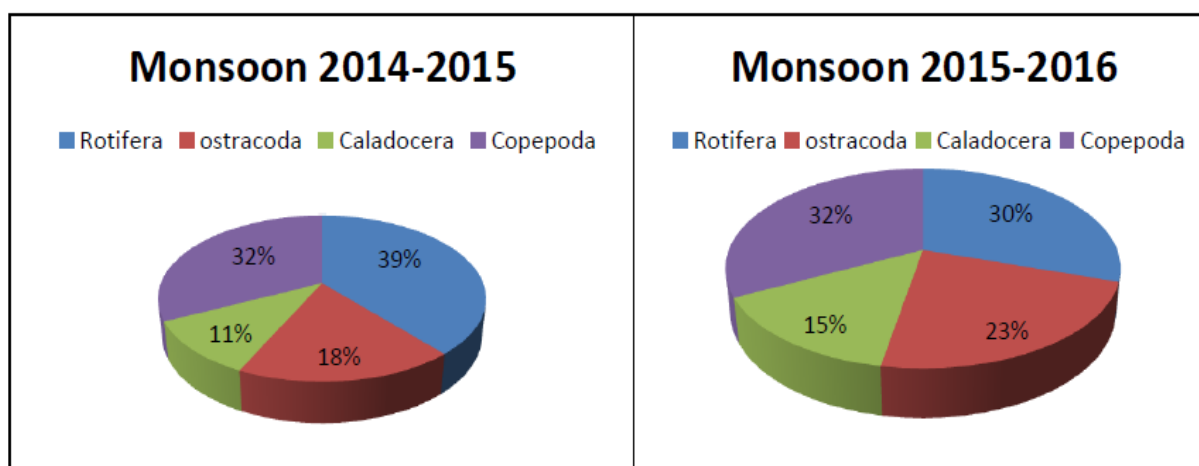
8	Simocephalus spp.	0	0	0	0	0	0	1	1	0	0	0	0	2
C	Family:Moinidae													
9	Moinamicrura	0	0	0	0	8	10	11	5	0	7	2	0	43
10	Bosminalongirostris	0	0	0	0	0	0	1	2	0	0	0	0	3
D	Family:Macrothricidae													
11	Macrothrixgoeldii	0	0	0	0	0	0	3	0	1	2	0	0	6
12	Macrothrixlaticornis	0	0	0	0	0	0	0	2	0	2	0	0	4
13	Echiniscatriserialis	0	0	0	0	0	0	0	0	0	0	0	0	0
14	Echiniscaodiosa	0	0	0	0	0	0	1	0	0	0	0	0	1
E	Family:Chydoridae													
15	Chydorussphaearicus	2	0	0	0	0	0	2	0	1	3	4	2	14
16	Pluroxusaduncus	0	0	0	0	0	0	0	2	0	0	0	0	2
17	Alonella spp.	0	0	0	0	0	0	0	1	0	0	0	0	1
18	Alonarectangularectangula	0	0	0	0	0	0	2	1	1	2	0	0	6
19	Alonarectangularichardi	0	0	0	0	1	0	2	4	0	0	0	0	7
20	Alonadavidipunctata	0	0	0	0	0	0	2	5	8	0	0	0	15
21	Camptocercus spp.	0	0	0	0	0	0	0	0	0	0	0	0	0
	TOTAL=	4	2	0	0	16	27	47	44	26	24	13	6	209
	COPEPODA													
22	Mesocyclop spp.	10	5	0	0	12	5	2	2	4	8	7	8	63
23	Eucyclop spp.	8	8	0	0	0	5	6	7	7	8	9	8	66
24	Cyclop spp.	8	2	0	0	8	6	7	5	5	8	7	10	66
25	Diaptomus spp.	8	5	0	0	0	5	8	5	6	7	8	10	62
	TOTAL=	34	20	0	0	20	21	23	19	22	31	31	36	257

Table3. Total number of Zooplankton at GulabSagar water body, Jodhpur during the year 2014-2015

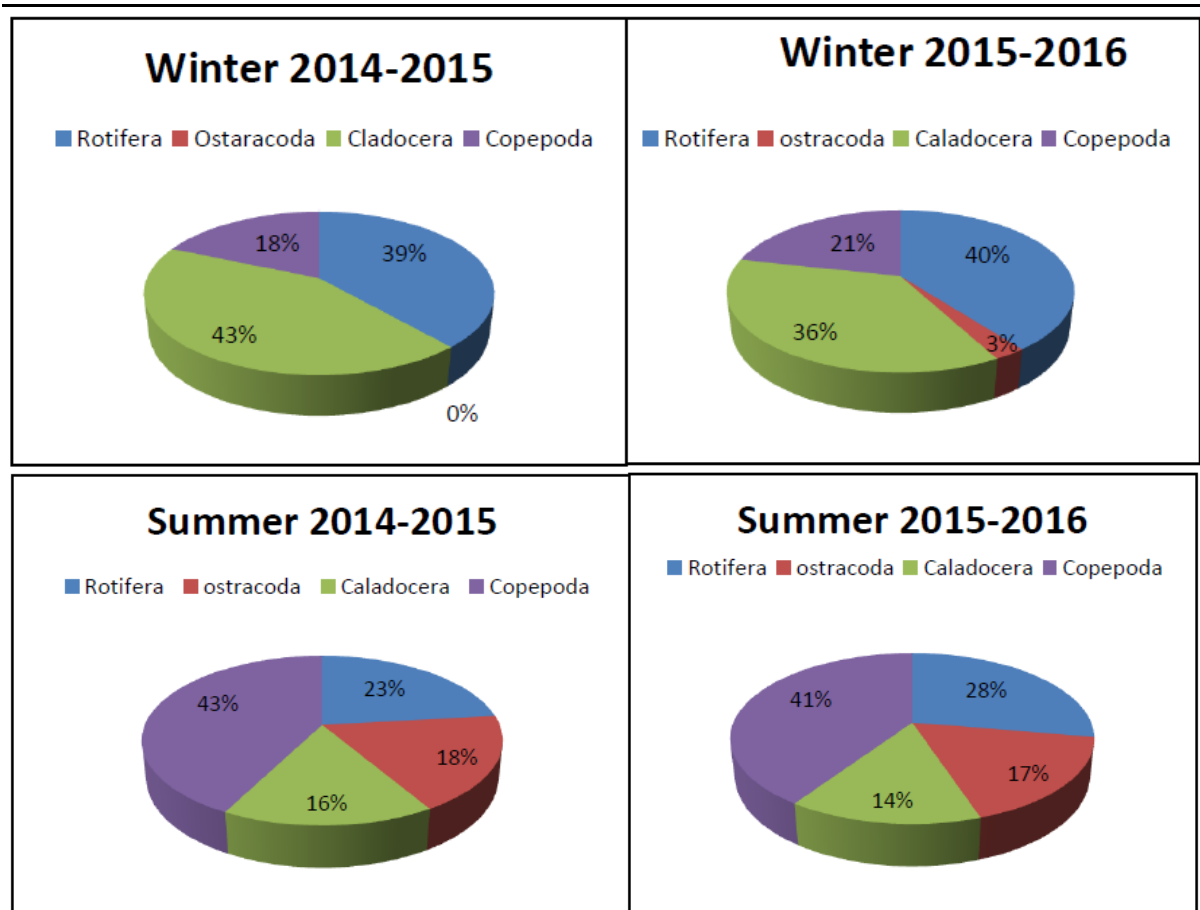
Zooplankton	Year 2014-1015															
	Monthly Seasonal															
	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mon	Win	Sum	Total
Rotifera	8	15	0	0	21	33	42	33	15	7	33	26	36	123	74	233
ostracoda	12	10	0	0	7	0	0	0	0	15	17	14	17	0	58	75
Caladocera	2	3	0	0	7	24	33	47	33	26	13	10	10	137	51	198
Copepoda	35	12	0	0	18	17	12	18	12	17	45	38	30	59	135	224
Total	57	40	0	0	53	74	88	98	60	65	108	88	93	319	318	730

Table4. Total number of Zooplankton at GulabSagar water body, Jodhpur during the year 2015-2016

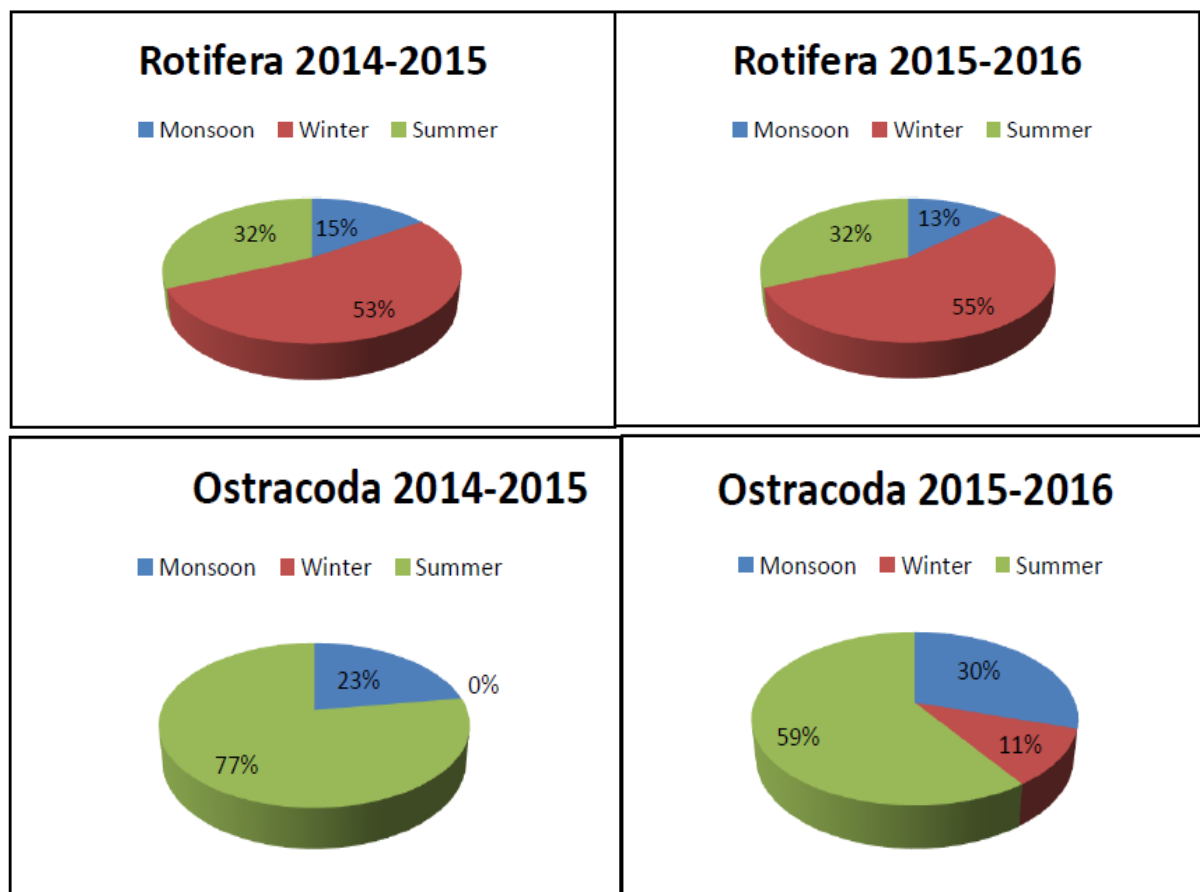
Zooplankton	Year 2015-2016															
	Monthly Seasonal															
	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mon	Win	Sum	Total
Rotifera	10	13	0	0	24	32	36	54	35	33	33	14	37	157	90	284
ostracoda	11	10	0	0	18	10	0	0	0	10	15	20	28	10	56	94
Caladocera	4	2	0	0	16	27	47	44	26	24	13	6	18	144	47	209
Copepoda	34	20	0	0	20	21	23	19	22	31	31	36	40	85	132	257
Total	59	45	0	0	78	90	106	117	83	98	92	76	123	396	325	844

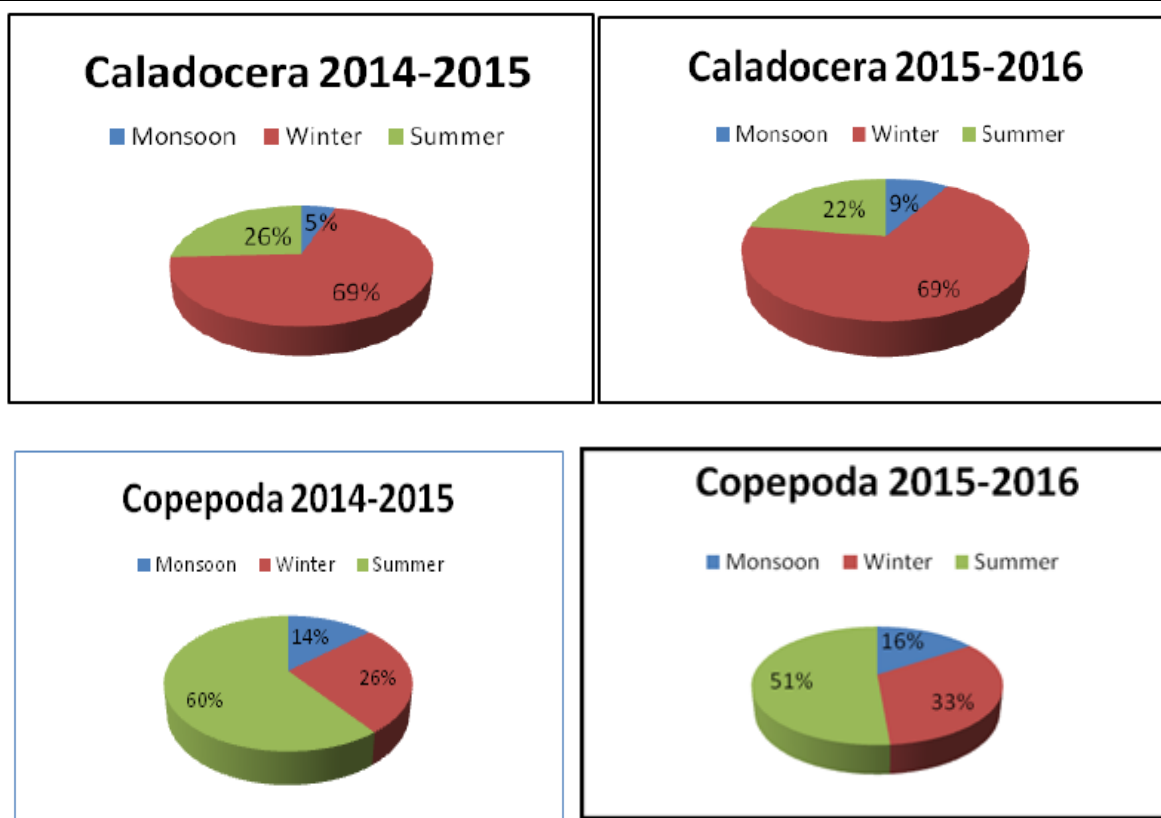


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Graph1. Seasonal distribution of Zooplanktons during Monsoon, Winter and Summer Season at GulabSagar water body, Jodhpur





Graph2. Seasonal distribution of Rotifera, Ostracoda, Cladocera and Copepoda at GulabSagar water body, Jodhpur

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