Zooplankton diversity and seasonal variation of Majalgaon Reservoir, Maharashtra State, India

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doi: 10.6088/ijes.6067

ABSTRACT

The present communication deals with the study of Zooplankton diversity and seasonal variation in Majalgaon Reservoir was conducted to check the status in the area and provide new insights into its ecology. The study was carried out during the period of one annual cycle i.e. January 2014 to December 2014. A total of 23 species were found in this reservoir. Among these, rotifers comprise of 8 species (28.92%), Cladocera 6 (19.638%), Copepods 5 (20.09%), Ostracoda 2 (19.317 %) and Protozoa 2 (12.02). The season wise zooplankton analysis showed that the number of population was highest during summer, followed by monsoon and lowest during winter.

Keywords: Majalgaon Reservoir, Zooplankton, Seasonal variation, Diversity.

1. Introduction

Zooplanktons are the smallest organisms present in almost all the water body. They invariably form an integral component for fresh water communities and contribute significant to biological productivity. Zooplankton acts as main sources of food for many fishes and plays an important role in early detection and monitoring the pollution of water. The study of zooplankton has been a fascinating subject for a long time. In the last two decades much attention has been paid in tropical countries towards the study of biology, ecology and toxicology of zooplankton due to their important role in the rapidly emerging concepts in environmental management like Environmental Impact Assessment (EIA), bio indication of pollution and biological monitoring (Salve and Hiware, 2010). Zooplankton is good indicators of the changes in water quality because they are strongly affected by environmental conditions and respond quickly to changes in water quality. Zooplankton is the intermediate link between phytoplankton and fish. Hence qualitative and quantitative studies of zooplankton are of great importance in Reservoir water body.

2. Material and methods

2.1 Study Area

Majalgaon Reservoir is one of the ancient, historical reservoirs constructed on Sindhthana River. The Majalgaon Reservoir is perennial and lies between 16°16’- 21°26’ N Latitude and 77°44’ – 70°15’ E longitude. Majalgaon Reservoir was built on Sindphana river in the basin of Godavari River. The reservoir is located approximately 3 km northwest of Majalgaon Thasil Maharashtra, India. This reservoir is a multipurpose used for different activities like drinking water supply, irrigation, fisheries, Cattle etc.
2.2. Collection of sample, preservation, Identification

Water samples were collected randomly in different three selected site of the reservoir on monthly basis for a period of one year from January 2014 to December 2014. Collection of Zooplankton was carried out by using plankton net. Sampling was made between 8.00 am to 10.00 am. By Plankton net (mesh size 25 mm) was swept through surface water. 100 lit of surface water were sieved through the plankton net and filtered sample were transferred to plastic containers and 4% formalin was added for sample preservation. These samples were then brought to laboratory for further studies. The systematic identification of plankton was made by using standard keys of Adoni (1985), IAAB (1998), Michael and Sharma (1988), Krishnaswamy (1973), Edmondson (1959), Pennak (1968), Dhanapathi (2000), Altaff (2004).

3. Results and discussion

A total 23 species of zooplankton were recorded from Majalgaon reservoir. Among 23 species, Rotifera was dominant with 08 species followed by 6 species of Cladocera, 05 species of Copepoda and 02 species of Ostracoda and Protozoa(Table 1). Monthly recorded variation of Zooplankton population is depicted in Table 2. The total numbers of species recorded were 11514.67 of which rotifers are 3330.333 (28.92%), Cladocerons 2261.333 (19.638%) copepods 2313.667 (20.09%), Ostracods 2224.333 (19.317%) and protozoa 1385(12.02%)Table 3.

The present study the occurrence of season wise zooplankton groups was dominant in the following increasing orderTable 4.

<table>
<thead>
<tr>
<th>Season</th>
<th>Dominant Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>Rotifera &gt; Ostracoda &gt; Copepoda &gt; Cladocera &gt; Protozoa</td>
</tr>
<tr>
<td>Summer</td>
<td>Rotifera &gt; Copepoda &gt; Cladocera &gt; Ostracoda &gt; Protozoa</td>
</tr>
<tr>
<td>Rainy</td>
<td>Rotifera &gt; Copepoda &gt; Cladocera &gt; Ostracoda &gt; Protozoa</td>
</tr>
</tbody>
</table>

3.1 Rotifers

Rotifers play a vital role in the trophic tiers of freshwater impoundments and serve as living capsule of nutrition (Suresh Kumar et al., 1999). In the present study they dominated with 08 species as compared to other groups of zooplankton. Taxonomic dominance has been reported in several water bodies (Kudari et al., 2005; Kanagasabhapati and Rajan, 2010). This pattern is common in lakes, ponds, reservoirs and rivers (Neves et al., 2003). The population density of rotifers was rich in summer season (1344.333 org/lit) and less in winter season (851.333 org/lit). The number of Rotifers increased in summer which may be due to the higher population of bacteria and organic matter of dead and decaying vegetation (Majagi and Vijaykumar, 2009). Segers (2003) highlighted the dominance of rotifer population which was due to its preference for warm waters. Planktonic rotifers have a very short life cycle under favorable conditions of temperature, food and photoperiod. Since the rotifers have short reproductive stages they increase in abundance rapidly under favorable environmental conditions (Dhanapathi, 2000). According to observation the Brachionus species are very common in temperate and tropical waters (Hutchinson, G. E. 1967) indicates alkaline nature of water. Excess growth of rotifers in lakes and reservoirs indicates due to the eutrophic conditions.
3.2 Cladocerons

Cladocerans are the most useful and nutritive group of crustaceans for higher members of fishes in the food chain. In the present study, a total of 6 species were recorded. The population densities of cladocera were higher in summer season (878.666 org/lit) and lower in winter (656 org/lit.). It was higher during summer followed by monsoon and lowest during winter. Abundance has also been earlier reported in summer season and lower in winter by Dushyantkumar Sharma (2012) in Thigra Reservoir Gwalior (M.P.). Cladocera is an order of small crustaceans commonly they are called by “water fleas”. It has been reported that the density and biomass of cladocerans was primarily determined by food supply (Smitha, P.G.et al 2007).

3.3. Copepods

Freshwater copepods constitute one of the major zooplankton communities occurring in all types of water bodies. They serve as food to several fishes and play a major role in ecological pyramids. In the present study, 5 species were recorded. Copepods showed higher population density in summer season (927 org/lit) and lower in winter (688.666 org/lit). This pattern of seasonal fluctuation of copepods has also been observed by Mahor (2011) in Trigha reservoir of Gwalior. Abundance of copepods in summer and monsoon is due to the lake which is rich in organic matter supporting higher number of Cyclopoids, thus suggesting their preponderance in higher trophic state of water. Similar observations are made by Somani and Pejavar (2004) in Masunda Lake. Absence of parthenogenetic form of copepod might be responsible for their low population density in monsoon season (Mustapha, 2009).

1.4 Ostracods

Ostracod represented very low diversity and population density as compared to other groups of zooplankton. In the present study, 2 species of ostracods were recorded. The population density was higher in summer season (851 org/lit) and less in Monsoon (637 org/lit). This result has also been observed by Sukand and Patil (2004) in Fort Lake of Belgaum and Kedar et al. (2008) in Rishi freshwater lake of Washim district. Occurance of some species of ostracods in Dharwad district has been reported (Patil C.S.et al1989).

3.5 Protozoa

These are the very diverse group of unicellulareukaryotic organisms Edward Alcamo et al. (2009) any of which are motile. I haverecorded Paramocium caudatum and virticella companula. In the present study, 2 species of protozoa were recorded. The population density was higher in summer season (590.333 org/lit) and less in Monsson (379.333 org/lit). similar observation were made by Shivashankar P. et al (2013) at Bhadra Reservoir, Karnataka. The study indicates seasonal variations in the distribution of zooplanktons. Rotifera, cladocera,copepod, Ostracoda and protozoa were found in maximum number during summer, followed by winter and minimum during monsoon. In case of ostracoda and copepoda, maximum number was recorded during summer, followed by monsson and least in winter. All over population of zooplankton washigh in summer and winter season; and low in mansoon season, rotifers and Cladocera were dominated over copepod, Ostracod and Protozoa by population throughout the year. Similar observations have been made by Das(2002) and Dushyant kumar et al (2012). Primary production is responsible for increasing the population density of zooplanktons in summer season. Normally mansoon is associated with
lower densities due to its dilution effect and decreased photosynthetic activities by primary productivity. Similar results were reported by Salve and Hiware (2010) in Wanprakalpa reservoir of Nagapur. The abundance of some zooplankton in the aquatic food web has been reported to indicate eutrophication (Halbach et al., 1983). Sharma and Diwan, (1993) studied plankton dynamics of Yeshwanth Sagar reservoir in which the Cladocera showed maximum density in June. They reported rotifers to form a dominant group during summer in Yeshwanth Sagar reservoir. Khare, (2005) observed an increasing trend in the months of winter season with peak during summer months - March to June. He recorded minimum population during rainy season. Kadam et al., (2006) observed maximum number of rotifers during summer season.

Five genera of rotifers, three genera of cladocerans and ostracods and two genera each in respect of protozoans and copepods in virla reservoir, Madhya Pradesh were observed Pathak S. K.et al (2002). While analyzing seasonal dynamics of rotifers in relation to physicochemical conditions of lotic water body made similar observations in increased densities of zooplanktons in summers and reduced densities in winters Arora, J. and Mehra, N.(2003). In summer season the absence of inflow of the water brings stability to the water body. The availability of food is more due to production of organic matter and decomposition Kiran B.R et al (2007). The seasonal variation and Zooplankton diversity in Thigra Reservoir Gwalior (M.P.) reported that total 20 species recorded during the study, 10 belonged to rotifera, 4 each to copepod and cladocera and 2 to protozoa. Rotifera was the most dominant group throughout the study period. Seasonal variations were observed in the distribution of zooplanktons. Seasonally, the number was highest during summer, followed by monsoon and lowest during winter by Dushyant Kumar Sharma (2012).

**Table 1. Checklist of Zooplankton from Majalgaon Reservoir**

**Rotifera**
1. *Brachionus calyciflorus* (Pallas, 1834)
2. *Brachionus caudatus* (Barrois and Daddy, 1894)
3. *Brachionus forficule* (Weirzejski, 1891)
4. *Brachionus angularis* (Gosse, 1851)
5. *Brachionus bidentata* (Jokubsky, 1912)
6. *Trichotria tetractis* (Ehrenberg, 1830)
7. *Polyarthra major* (Burekhardt, 1900)
8. *Filinia terminalis* (Plate, 1886)

**Cladocera**
1. *Moina macrocopa* (Straus, 1820)
2. *Moina micrura* (Kurz, 1874)
3. *Diaphanosoma excisum* (Sars, 1865)
4. *Daphnia longirimis* (Sars, 1861)
5. *Leydigo acanthocercoids* (Fischer, 1854)
6. *Ceriodaphnia cornuta* (Sars, 1885)

**Copepoda**
2. *Trpocylop prasinus* (Fischer, 1886)
3. *Paracyclop fermbrialis* (Fischer, 1853)
4. *Mesocyclop leucarti* (Claus, 1857)
5. *Mesocyclops hyalinus* (Rehberg, 1880)

**Ostracoda**
1. *Hemicypris fossulata* (Baird, 1845)
2. *Cypris globosa* (Baird, 1845)

**Protozoa**
1. Paramecium cadatum
2. Vorticella companula

**Table 2:** Monthly variation of zooplankton (No./Lit) at three stations of Majalgaon Reservoir, Marathwada, Maharashtra

<table>
<thead>
<tr>
<th>Month/ Stations</th>
<th>Rotifera</th>
<th>Cladocera</th>
<th>Copepods</th>
<th>Ostracoda</th>
<th>Protozoa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>223</td>
<td>180</td>
<td>178</td>
<td>167</td>
<td>121</td>
</tr>
<tr>
<td>Feb</td>
<td>278</td>
<td>130</td>
<td>190</td>
<td>190</td>
<td>180</td>
</tr>
<tr>
<td>Mar</td>
<td>267</td>
<td>201</td>
<td>190</td>
<td>200</td>
<td>190</td>
</tr>
<tr>
<td>Apr</td>
<td>345</td>
<td>235</td>
<td>276</td>
<td>234</td>
<td>222</td>
</tr>
<tr>
<td>May</td>
<td>467</td>
<td>250</td>
<td>256</td>
<td>278</td>
<td>298</td>
</tr>
<tr>
<td>Jun</td>
<td>425</td>
<td>267</td>
<td>250</td>
<td>200</td>
<td>199</td>
</tr>
<tr>
<td>Jul</td>
<td>334</td>
<td>123</td>
<td>145</td>
<td>167</td>
<td>199</td>
</tr>
<tr>
<td>Aug</td>
<td>213</td>
<td>145</td>
<td>123</td>
<td>145</td>
<td>199</td>
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<tr>
<td>Sept</td>
<td>200</td>
<td>146</td>
<td>134</td>
<td>165</td>
<td>199</td>
</tr>
<tr>
<td>Oct</td>
<td>224</td>
<td>167</td>
<td>178</td>
<td>185</td>
<td>199</td>
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<tr>
<td>Nov</td>
<td>190</td>
<td>165</td>
<td>140</td>
<td>170</td>
<td>199</td>
</tr>
<tr>
<td>Dec</td>
<td>211</td>
<td>155</td>
<td>150</td>
<td>175</td>
<td>199</td>
</tr>
<tr>
<td>Total</td>
<td>3375</td>
<td>2674</td>
<td>2501</td>
<td>2001</td>
<td>1991</td>
</tr>
<tr>
<td>Mean</td>
<td>3330.333</td>
<td>2261.333</td>
<td>2313.667</td>
<td>2287</td>
<td>2357</td>
</tr>
</tbody>
</table>

**Table 3:** Zooplankton variation of Majalgaon Reservoir during January 2014 to December 2014

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Group</th>
<th>Number of organism</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rotifera</td>
<td>3330.333</td>
<td>28.92%</td>
</tr>
<tr>
<td>2</td>
<td>Cladocera</td>
<td>2261.333</td>
<td>19.63%</td>
</tr>
<tr>
<td>3</td>
<td>Copepoda</td>
<td>2313.667</td>
<td>20.09%</td>
</tr>
<tr>
<td>4</td>
<td>Ostracoda</td>
<td>2224.333</td>
<td>19.31%</td>
</tr>
<tr>
<td>5</td>
<td>Protozoa</td>
<td>1385</td>
<td>12.02%</td>
</tr>
</tbody>
</table>

**Table 4:** GroupWise seasonal variation of zooplankton in Majalgaon Reservoir during January 2014 to December 2014

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Seasons</th>
<th>Rotifera</th>
<th>Cladocera</th>
<th>Copepoda</th>
<th>Ostracoda</th>
<th>Protozoa</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Summer</td>
<td>1344.333</td>
<td>878.6667</td>
<td>927</td>
<td>851</td>
<td>590.333</td>
</tr>
<tr>
<td>2</td>
<td>Monsoon</td>
<td>1134.667</td>
<td>662.3333</td>
<td>698</td>
<td>637</td>
<td>379.333</td>
</tr>
<tr>
<td>3</td>
<td>Winter</td>
<td>851.333</td>
<td>656</td>
<td>688.666</td>
<td>736.333</td>
<td>415.333</td>
</tr>
</tbody>
</table>
4. Conclusions

The present study reveals seasonal variation in the diversity and distribution of zooplanktons in Majalgaon Reservoir. All five groups of zooplanktons were recorded throughout the study period. The number was highest during summer and lowest during winter. The study indicates that temperature has an important role in the distribution of zooplanktons in a freshwater habitat.

Acknowledgement

The authors are thankful to the Principal, Majalgaon Arts, Science and Commerce College, Majalgaon, for providing the laboratory facility and also thankful to the UGC for providing the financial assistance under the minor Research project Scheme in the subject Environmental Science.

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