Short Communication

Species Diversity and Distribution of Zooplankton of Western Yamuna Canal in Yamunanagar (Haryana) India with Special Reference to Industrial Pollution

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Abstract

Zooplankton are the very important part of the aquatic ecosystem serve as good indicators of changes in water quality. The present studies deals with the variations in zooplankton population in relation to industrial effluents. Three sampling points i.e. station-W1: Upstream of the canal; Station-W2: Point of influx of industrial effluents and city sewage; Station-W3: About 6 kms downstream from station W2 were selected for the investigation. The results revealed a significant (P<0.05) decline in the population of zooplankton from station W1 to W2, however, a slight increase in population was observed at station W3. Species diversity also follows the same trend. Various pollution indicating physicochemical parameters have been correlated with zooplankton indicating the effect of DO, BOD and pH on zooplanktonic population and diversity.

Keywords: Industrial effluents, Physico-chemical characteristics, species diversity, zooplankton.

Introduction

The microscopic free swimming animal components of aquatic system constitute zooplankton. Zooplankton are known not only to form an integral part of the lotic community but also contribute significantly to the biological productivity of fresh water ecosystem1,2,3. Zooplankton density has also been reported to vary depending on the availability of nutrients and the stability of the water4. Higher diversity means longer food chain and more cases of symbiosis increasing stability5. Several authors have made contributions to the study of zooplankton in relation to pollution3,6.

Western Yamuna canal emerges from the river Yamuna near Tajewala village in Yamunanagar which is an industrial city popular for its sugar industries and ply-wood works. The wastes from these industries and agricultural run-off and the drains carrying municipal sewage of the city enter into the canal and affecting its water quality and adverse effects on planktonic community. Hence the present study was undertaken in order to relate the effect of industrial effluents on zooplankton diversity of western Yamuna canal along its course through Yamunanagar district in Haryana state.

Material and Methods

Keeping in view the point of influx of discharges into river, three stations have been selected. Station-W1 lies in village Kalanaur at upstream of the river before the influx of discharges, Station-W2 lies 4-5 kms downstream from station W1 at middle reach of the river where the mill effluents joins the river, Station-W3 at 5-6 kms downstream from station-W2 after the influx of discharges (figure 1).

Zooplankton samples were collected by filtering 25 L of water through plankton net of mesh size 50µm with demarcating collecting tube. The abundance of zooplankton was expressed as organisms L-1. The organisms counted by drop count method were expressed per litre using formula:

\[
\text{Number of Organisms per litre} = \frac{\text{Number of Organisms per drop} \times \text{Volume of original sample in ml}}{\text{Volume of conc. sample in ml}}
\]

Species Diversity of zooplankton was determined using Shannan and Weaver diversity index method7,8.

\[
D = -\sum \frac{ni}{N} \log \frac{ni}{N}, \quad D = \text{Species Diversity}, \quad ni = \text{Number of individuals of } i^{th} \text{ species, } N = \text{Total number of individuals in the sample.}
\]

The coefficient of correlation “r” was calculated on computer using SPSS package.

Results and Discussion

Zooplankton occurs in all water bodies and is of fundamental importance to nutrient recycling and regenerated primary production9. Due to short life span and wide distributions of many zooplankton, these act as “ecological indicators”10. In the present studies, zooplankton community was comprised of only
4 taxa, belonging to Cladocera (3 taxa) and one taxon Miracidium larva of Trematoda. Cladocerans were dominant at all the stations with percentage distribution of 81.5 ± 1.55% (W1), 73.2 ± 2.80% (W2) and 73.7 ± 2.28% (W3) at various stations (figure 2). The great significance of Cladocerans in the aquatic food chain as food for both young and adult fish was emphasized much earlier. Total population of zooplankton was low and varied between 25-120 nos. L⁻¹ and showed a decrease from station W1 to station W3 (table 1). This may be due to influx of effluents at station W2 and more concentration of these effluents at station W3 because of obstruction in the path of flow of water. Significant (P < 0.05) negative correlation of zooplankton with BOD (r = – 0.45), free CO₂ (r = –0.513), alkalinity (r = –0.660), hardness (r= –0.490), chloride (r= –0.468) and sulphate (r = –0.419) also support the view. Species diversity was also low at station W2. No significant variation in the species composition of zooplankton were observed, however, Sidacrystallina (a Cladoceran) was absent at station W2 expect during April, May and June and was present in low number at station W3 indicating it as sensitive taxon. This, it can be designated as sensitive taxon. Cattaneo et al. and Walseng et al. have also reported Sidacrystallina as sensitive taxon. Other two Cladocerans, viz., Daphnia sp. and Simocephalus sp. were common to all stations depicting them tolerant to various pollution indicating parameters. Species diversity also showed a decline at station W2 and W3 indicating the effect of industrial pollution and sewage waste (table 2). Marglef et al. and Bhatnagar and Garg have emphasized the role of species diversity index in pollution and stated that a decrease in species diversity values point to polluted waters. These results depict station W2 as stressed area with reference to species diversity.

<table>
<thead>
<tr>
<th>Station W1</th>
<th>Station W2</th>
<th>Station W3</th>
</tr>
</thead>
<tbody>
<tr>
<td>November</td>
<td>67±4.96</td>
<td>25±4.96</td>
</tr>
<tr>
<td>December</td>
<td>69±5.67</td>
<td>34±4.25</td>
</tr>
<tr>
<td>January</td>
<td>74±9.92</td>
<td>62±9.92</td>
</tr>
<tr>
<td>February</td>
<td>66±4.25</td>
<td>42±4.25</td>
</tr>
<tr>
<td>March</td>
<td>94±4.25</td>
<td>54±4.25</td>
</tr>
<tr>
<td>April</td>
<td>94±7.09</td>
<td>62±2.83</td>
</tr>
<tr>
<td>May</td>
<td>105±7.80</td>
<td>67±2.12</td>
</tr>
<tr>
<td>June</td>
<td>115±6.38</td>
<td>67±5.67</td>
</tr>
<tr>
<td>July</td>
<td>120±6.73</td>
<td>43±4.96</td>
</tr>
</tbody>
</table>

*Means with different letters are significantly (P < 0.05) different. (Data were analyzed by Duncan’s multiple range test)
Conclusion

The population density of the Zooplanktons along the stretch of Yamuna canal at Yamunanagar depicted that canal water, in general, is in a very poor trophic status. Low values of densities of zooplankton coupled with low species diversity which further decreased at station W2 where industrial and sewage channel joins the canal depicts the altered overall ecology of the stream thus reducing the capture fishery statistics. Therefore, the proper and efficient treatment of sewage should be carried out before discharging them into the river system.

References

3. Hassan S., Gopinat G., Din M. And Altaff K., Qualitative and quantitative analysis of zooplankton of some important fresh water bodies of Tamilnadu and Kashmir, Jr. Exp Zoo., 12(2), 351-355 (2009)