



### 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 ecosystem<sup>1,2,3</sup>.

Zooplankton density has also been reported to vary depending on the availability of nutrients and the stability of the water<sup>4</sup>. Higher diversity means longer food chain and more cases of symbiosis increasing stability<sup>5</sup>. Several authors have made contributions to the study of zooplanktons in relation to pollution<sup>3,6</sup>.

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 50 $\mu$ m with demarcating collecting tube. The abundance of zooplankton was expressed as organisms L<sup>-1</sup>. The organisms counted by drop count method were expressed per litre using formula:

$$\text{Total Planktons L}^{-1} = \frac{\text{Number of Organisms per drop} \times \text{Vol. of conc. sample in ml}}{\text{Volume of original sample in litres} \times \text{Vol. of one drop}}$$

Species Diversity of zooplankton was determined using Shannon and Weaver diversity index method<sup>7,8</sup>.

$D = - \sum \frac{n_i}{N} \log_2 \frac{n_i}{N}$ , D = Species Diversity,  $n_i$  = Number of individuals of  $i^{\text{th}}$  species, N = 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 production<sup>9</sup>. Due to short life span and wide distributions of many zooplankton, these act as "ecological indicators"<sup>10</sup>. In the present studies, zooplankton community was comprised of only

4 taxa, belonging to Cladocera (3 taxa) and one taxa *Miracidium* larva of Trematoda. Cladocerans were dominant at all the stations with percentage distribution of  $81.5 \pm 1.55\%$  (W1),  $73 \pm 2.80\%$  (W2) and  $73.7 \pm 2.28\%$  (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<sup>11</sup>. 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  $CO_2$  ( $r = -0.513$ ), 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 taxa. Thus, it can be designated as sensitive taxon. Cattaneo *et al.*<sup>12</sup> and Walseng *et al.*<sup>13</sup> 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<sup>14</sup>, Trivedi<sup>15</sup> and Bhatnagar and Garg<sup>16</sup> 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.

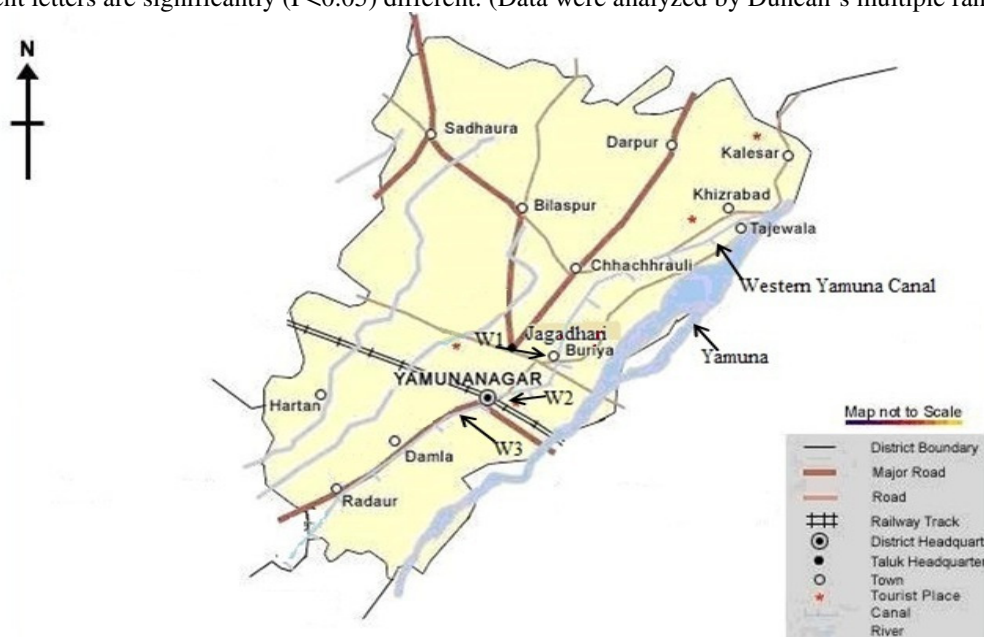
**Table-1**  
**Total number of Zooplankton ( $L^{-1}$ ) (mean  $\pm$  S.E of mean) of western Yamuna canal at various stations**

	Station W1	Station W2	Station W3
November	67 $\pm$ 4.96	25 $\pm$ 4.96	45 $\pm$ 5.67
December	69 $\pm$ 5.67	34 $\pm$ 4.25	49 $\pm$ 6.38
January	74 $\pm$ 9.92	62 $\pm$ 9.92	34 $\pm$ 1.41
February	66 $\pm$ 4.25	42 $\pm$ 4.25	48 $\pm$ 6.38
March	94 $\pm$ 4.25	54 $\pm$ 4.25	-
April	94 $\pm$ 7.09	62 $\pm$ 2.83	-
May	105 $\pm$ 7.80	67 $\pm$ 2.12	-
June	115 $\pm$ 6.38	67 $\pm$ 5.67	-
July	120 $\pm$ 6.73	43 $\pm$ 4.96	-

**Table-2**  
**Species diversity of Zooplankton of western Yamuna canal at various stations**

	November	December	January	February	March	April	May	June	July	Mean $\pm$ S.E of mean*
W1	1.9	1.8	1.9	2.3	2.3	1.8	1.8	2.0	1.7	1.9 $\pm$ 0.1 <sup>A</sup>
W2	1.6	1.6	1.5	1.5	1.4	1.7	1.6	1.9	1.5	1.6 $\pm$ 0.0 <sup>B</sup>
W3	2.0	1.6	1.7	1.7	-	-	-	-	-	1.8 $\pm$ 0.1 <sup>AB</sup>

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



**Figure-1**  
**Map showing location of selected stations on western Yamuna canal**

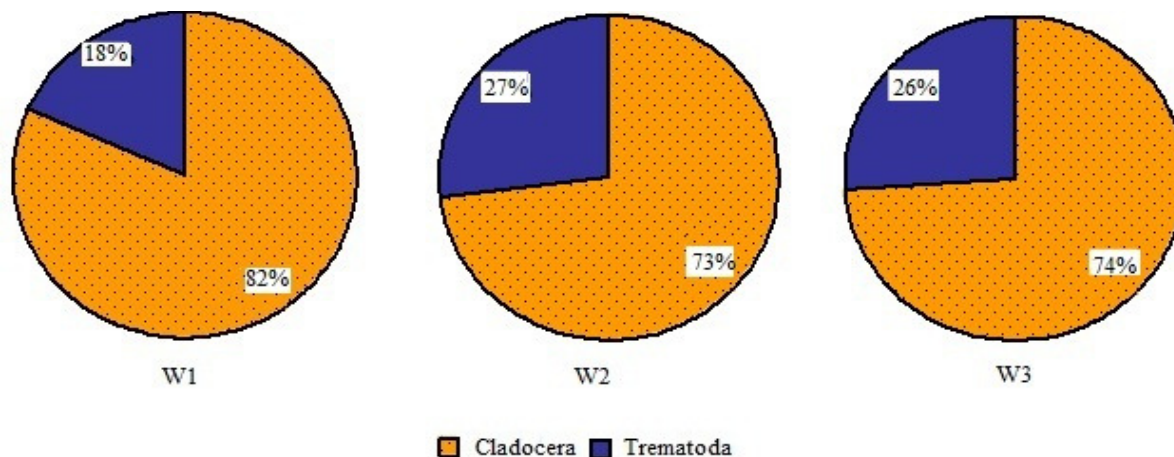


Figure-2  
Percentage distribution of Zooplankton of western Yamuna canal at various stations

## 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 tropic 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.

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