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Fortnight Variations of Plankton in Jawan Nehar of Aligarh, India

K.M.A.A. Saddam Hussain, Saltanat Parveen, Uzma Ahmad*,
Taskeena Hassan and Bilal Nabi Bhat

Limnology laboratory, Department of Zoology Aligarh Muslim University,
Aligarh. U.P. India

*Corresponding author

ABSTRACT

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For the present study, Jawan canal also known as “Jawan Nehar” was selected. Jawan canal was constructed near the sumera hydroelectric power plant to use the Ganges canal as a source of water to generate electricity. Sampling was done between 7 am and 9 am on fortnight basis from 30th March, 2015 to 12 June, 2015. During the investigations total fourteen species of phytoplankton belonging to different families were recorded as *Ankistrodesmus* sp., *Cosmarium* sp., *Clostridium* sp., *Closteriopsis* sp., *Diatoma* sp., *Genicularia* sp., *Fragilaria* sp., *Nostoc* sp., *Navicula* sp., *Nitzschia* sp., *Oscillatoria* sp., *Spirogyra* sp., *Scenedesmus* sp., and *Spirulina* sp. Phytoplankton in Jawan Nehar varied from a minimum of 86 No/ml on 30th April, 2015 to a maximum of 159 No/ml on 30th March, 2015. Statistically, phytoplankton showed positive correlation with zooplankton ($r = 0.608$) and with dissolved oxygen ($r = 0.501$); significant negative correlation with water temperature ($r = -0.682$), carbon dioxide ($r = -0.690$) and pH ($r = -0.504$) and total seven species of Zooplankton belonging to different families were recorded as *Brachionus* sp., *Cyclops* sp., *Cypriodopsis* sp., *Diaptomus* sp., *Keratella* sp., *Mesocyclops* sp. and *Philodina* sp. zooplankton in Jawan Nehar varied from a minimum of 27 No./ml on 30 April, 2015 to a maximum of 54 No./ml on 15 April, 2015. Statistically, zooplankton showed significant negative correlation with carbon dioxide ($r = -0.568$).

Introduction

Water is a vital part of our lives. We drink it. We wash with it. We use water for irrigating crops, for transporting goods, as well as, for generating energy at hydroelectric dams and nuclear power plants. Lotic aquatic systems are those systems which contain flowing waters. The mass of water in these systems is in a state of perpetual motion. Streams and rivers are familiar examples of such systems.

The basic function of these lotic bodies of water is to carry the surplus rain water back to the sea. In and around freshwater bodies many aquatic organisms are found which also complete their life cycle in it. In fresh water flora aquatic fauna abundantly present. Organisms that passively drift, maintained in suspension by water current or float or swim weakly, comprise the plankton. Plankton play role as herbivore,

carnivore, omnivore, decomposers and detritivores. They serve as food for the economically important culturable Indian major carps and their fingerlings. They include heterotrophic, bacterioplankton, and photosynthetic phytoplankton and the swimming zooplankton. Phytoplankton consists for the most part of single celled organisms physiologically similar to land plants but far smaller suspended in the liquid medium that nourishes them. Zooplankton are microscopic free floating animals which play a vital role in aquatic food web. They are choice food of fishes in general and juveniles in particular. They graze on algae, bacteria and micro invertebrates. Zooplankton communities are typically diverse and occur in almost all water bodies. The species assemblage of phytoplankton and zooplankton are also useful in assessing the water quality because of their short life span. Plankton response quickly to environmental factors and hence their standing crop and species composition are more likely to indicate the quality of water mass in which they live. The present study is undertaken to analyze the plankton of Jawan canal.

Study Area

For the present study, Jawan canal also known as "Jawan Nehar" was selected. Jawan canal was constructed near the sumera hydroelectric power plant to use the Ganges canal as a source of water to generate electricity, Over the Jawan canal a bridge called as the Jawan Bridge was constructed, over which the Aligarh Moradabad highway passes now. Jawan canal is basically situated on the Aligarh - Moradabad highway (Anoopshar road) at a distance of sixteen Kilometers from Aligarh and 25 kilometers from Aligarh Muslim University, campus. Canal water is used by the community for Irrigation, bathing and

washing of clothes and cattles.

Climate

Aligarh a district of western Uttar Pradesh in North India located in the central Ganga Yamuna Doab at latitude 27 54'N and longitude 78 4'E . The winter season is marked with considerable fall in temperature (8 °C). The nights are cold and dry and are moderately warm. The post-winter season is marked with the gradual rise in temperature (21°C) bright sun shine, absence of cloudy days, a gradual lengthening of the photoperiod and lower relative humidity.

The summer season is marked with considerable rise in temperature and long photoperiod. In the month of May and June, temperature rises exceptionally high with mercury touching some time to 48 °C during noon time and fast currents of hot and dry air blow in day time.

Summer is followed by Monsoon season. The rains (247 mm) generally begin in July and lasts till the end of September. This season is characterized by a gradual fall in temperature.

Materials and Methods

Sampling from the selected water body was done between 7 am and 9 am on fortnight basis from 30th March, 2015 to 12 June, 2015 and different physico-chemical and biological parameters were analyzed following APHA (1998), Theroux *et. al* (1943) and Trivedy and Goel (1984).

Plankton Analysis

Phytoplankton Analysis

Samples were collected from water body fortnightly between 7 am and 9:00 am. To

each 500 ml sample, 5 ml of Lugol's Iodine solution (Edmondson, 1959) was added. After keeping it for 24 hours the supernatant was discarded and 20 ml concentrate was obtained. Qualitative and qualitative analysis were done using an inverted microscope. For making qualitative analysis keys given by Edmondson (1959), APHA (1998) and Needham and Needham (1962) were utilized. For making quantitative analysis, counting was made by putting one drop of concentrate on a slide and observing the content under inverted microscope (Metzer). Results were expressed in No. /ml.

For Zooplankton Analysis

Samples were collected fortnightly from the site between 7:30 am to 9:00 am. About 30 liters of water was filtered by plankton net made up of blotting silk cloth having mesh size of 25 µm. Samples were then washed into wide mouth bottles and were preserved by adding 5% formaldehyde solution. Further analysis was done by putting 1 ml of the preserved sample on a Sedgewick Rafter cell and studying it under an inverted microscope (Metzer).

For qualitative analysis, the keys given in Edmondson (1959), Needham and Needham (1962). Pennak (1978) and APHA (1998) were utilized and results were expressed in No/ml.

Results and Discussion

Water temperature was always found to be less than air temperature and followed the trend of air temperature. The reason for alkaline pH in present study could be related to enhanced photosynthesis carried out by aquatic macrophytes and algae which remove, free CO₂. The decline in dissolved oxygen content during summer and monsoon months in present study could be attributed to ever increasing water temperature leading to decrease in oxygen retention capacity of water. The presence CO₂ may be due to decomposition of accumulated detritus from on the margins and high input of inflowing sewage. (Table-1)

During the present study total fourteen genera of phytoplankton belonging to different families were recorded as *Ankistrodesmus* sp., *Cosmarium* sp., *Clostridium* sp., *Clostriopsis* sp., *Diatoma* sp., *Genicularia* sp., *Fragilaria* sp., *Nostoc* sp., *Navicula* sp., *Nitzchia* sp., *Oscillatoria* sp., *Spirogyra* sp., *Scenedesmus* sp., and *Spirulina* sp. (Table-2 and figure-I).

Phytoplankton in Jawan Nehar varied from a minimum of 86 No/ml on 30th April, 2015 to a maximum of 159 No/ml on 30th March, 2015 (Table-2 and Figure-II).

Table.1 Fortnight Variations of Different Physico-Chemical Parameters in Jawan Nehar

| Date | Air Temperature (°C) | Water Temperature (°C) | pH | D.O (mg/l) | CO ₂ (mg/l) |
|------------|----------------------|------------------------|-----|------------|------------------------|
| 30-03-2015 | 30.0 ⁰ C | 27.0 ⁰ C | 6.5 | 6.1 | 11.0 |
| 15-04-2015 | 34.0 ⁰ C | 31.0 ⁰ C | 7.2 | 4.2 | 10.2 |
| 30-04-2015 | 39.0 ⁰ C | 37.0 ⁰ C | 7.5 | 3.8 | - |
| 17-05-2015 | 40.0 ⁰ C | 38.0 ⁰ C | 8.0 | 4.5 | - |
| 2-06-2015 | 43.0 ⁰ C | 41.0 ⁰ C | 8.3 | 3.0 | 19.2 |
| 12-06-2015 | 45.0 ⁰ C | 43.0 ⁰ C | 8.0 | 4.2 | - |

Table.2 Abundance and Distribution of Phytoplankton (no./ml) in Jawan Nehar

| Genera | Date 30/03/15 | Date 15/04/15 | Date 30/04/15 | Date 17/05/15 | Date 02/06/15 | Date 12/06/15 |
|--------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| Phytoplankton | | | | | | |
| <i>Oscillatoria sp.</i> | 30 | 25 | 10 | 03 | 09 | 07 |
| <i>Diatoma sp.</i> | 17 | 02 | 07 | 08 | 05 | 01 |
| <i>Navicula sp.</i> | 05 | 12 | 00 | 04 | 14 | 00 |
| <i>Nitzschia sp.</i> | 03 | 00 | 02 | 00 | 05 | 00 |
| <i>Clostridium sp.</i> | 11 | 18 | 00 | 00 | 00 | 00 |
| <i>Spirogyra sp.</i> | 04 | 09 | 00 | 22 | 36 | 26 |
| <i>Genicularia sp.</i> | 02 | 07 | 04 | 04 | 09 | 06 |
| <i>Cosmarium sp.</i> | 04 | 11 | 07 | 09 | 10 | 05 |
| <i>Scenedesmus sp.</i> | 16 | 04 | 06 | 04 | 06 | 00 |
| <i>Akistrodesmu ssp.</i> | 08 | 19 | 00 | 18 | 20 | 22 |
| <i>Nostoc sp.</i> | 03 | 05 | 04 | 00 | 02 | 00 |
| <i>Closteriopsis sp.</i> | 07 | 03 | 09 | 05 | 00 | 04 |
| <i>Fragellaria sp.</i> | 34 | 13 | 19 | 25 | 18 | 20 |
| <i>Spirullina sp.</i> | 15 | 14 | 18 | 20 | 00 | 10 |
| Grand Total | 159 | 142 | 86 | 122 | 134 | 101 |

Table.3 Abundance and Distribution of Zooplankton.(No./ml) in Jawan Nehar

| GENERA | 30/03/15 | 15/04/15 | 30/04/15 | 17/05/15 | 2/06/15 | 12/06/15 |
|------------------------|-----------------|-----------------|-----------------|-----------------|----------------|-----------------|
| <i>Copepodasp.</i> | | | | | | |
| <i>Cyclops sp.</i> | 17 | 21 | 11 | 06 | 05 | 01 |
| <i>Diatomus sp.</i> | 8 | 02 | 09 | 12 | 19 | 16 |
| <i>Mesocyclops sp.</i> | 03 | 09 | 05 | 00 | 00 | 00 |
| TOTAL | 28 | 32 | 25 | 18 | 24 | 17 |
| <i>Rotifera sp.</i> | | | | | | |
| <i>Brachionus sp.</i> | | | | | | |
| <i>Keratella sp.</i> | 03 | 17 | 02 | 13 | 02 | 08 |
| <i>Philodina sp.</i> | 01 | 00 | 00 | 00 | 05 | 09 |
| | 01 | 05 | 00 | 01 | 02 | 00 |
| TOTAL | 05 | 22 | 2 | 14 | 9 | 17 |
| <i>Ostracoda sp.</i> | | | | | | |
| <i>Cypridopsis sp.</i> | | | | | | |
| | 05 | 00 | 00 | 11 | 05 | 07 |
| TOTAL | 05 | 00 | 00 | 11 | 05 | 07 |
| Grand Total | 38 | 54 | 27 | 43 | 38 | 41 |

Table.4 Statistical Brief of Various Water Quality Parameters in Java Nehar

| Parameters | Parameters | Correlation (r value) | Significant at p=0.05 |
|--------------------------|-------------------|-----------------------|-----------------------|
| Air temperature | Water temperature | 0.999 | ✓ |
| Water temperature | Zooplankton | -0.206 | - |
| | Phytoplankton | -0.682 | ✓ |
| pH | Zooplankton | -0.065 | - |
| | Phytoplankton | -0.504 | ✓ |
| Dissolved Oxygen | Zooplankton | 0.103 | - |
| | Phytoplankton | 0.501 | ✓ |
| Carbon Dioxide | Zooplankton | -0.568 | ✓ |
| | Phytoplankton | -0.690 | ✓ |
| Phytoplankton | Zooplankton | 0.608 | ✓ |

Figure.1 Percent Composition of Phytoplankton and Zooplankton in Jawan Nehar

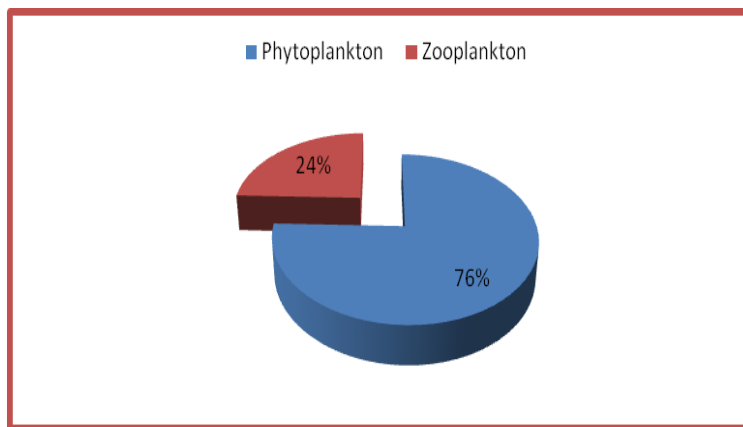
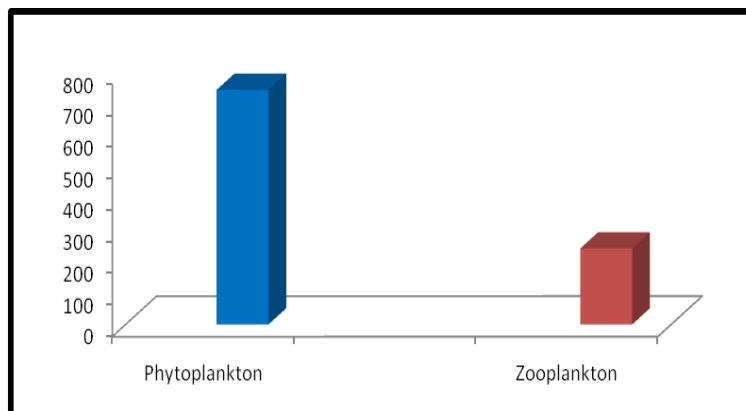


Figure.2 Histogram Showing Variation in Phytoplankton and Zooplankton (no./ml) of Jawan Nehar



Statistically, phytoplankton showed positive correlation with zooplankton ($r = 0.608$) and with Dissolved oxygen ($r = 0.501$); significant negative correlation with water temperature ($r = -0.682$), carbon dioxide ($r = -0.690$) and pH ($r = -0.504$) (Table-4). Chlorophyceae dominance indicates the eutrophic nature of the water body.

In the present study total seven species of zooplankton belonging to different families were recorded as *Brachionus* sp., *Cyclops* sp., *Cypridopsis* sp., *Diatomus* sp., *Keratella* sp., *Mesocyclops* sp. and *Philodina* sp. (Table-3 and figure-II).

Zooplankton in Jawan Nehar varied from a minimum of 27 No./ml on 30 April, 2015 to a maximum of 54 No./ml on 15 April, 2015 (Table-3 and figure-II). Statistically, zooplankton showed significant negative correlation with Carbon dioxide ($r = -0.568$) (Table-4). In the present study phytoplankton contribute about 76 % and zooplankton about 24 % of total plankton as shown in figure-I

In conclusion, the present survey indicates that Jawan reservoir is influenced by urbanization and human activities but suitable for survival of plankton and fish.

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