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**Kalpana Srivastava**  
ICAR-Central Inland Fisheries  
Research Institute, Regional  
Centre, 26 Panna Lal Road,  
Allahabad, Uttar Pradesh, India

**Sandeep Mishra**  
ICAR-Central Inland Fisheries  
Research Institute, Regional  
Centre, 26 Panna Lal Road,  
Allahabad, Uttar Pradesh, India

**Hari Om Verma**  
ICAR-Central Inland Fisheries  
Research Institute, Regional  
Centre, 26 Panna Lal Road,  
Allahabad, Uttar Pradesh, India

**Venkatesh R Thakur**  
ICAR-Central Inland Fisheries  
Research Institute, Regional  
Centre, 26 Panna Lal Road,  
Allahabad, Uttar Pradesh, India

**DN Jha**  
ICAR-Central Inland Fisheries  
Research Institute, Regional  
Centre, 26 Panna Lal Road,  
Allahabad, Uttar Pradesh, India

**Absar Alam**  
ICAR-Central Inland Fisheries  
Research Institute, Regional  
Centre, 26 Panna Lal Road,  
Allahabad, Uttar Pradesh, India

**BK Das**  
ICAR-Central Inland Fisheries  
Research Institute, Barrackpore,  
West Bengal, India

Corresponding Author:

**Kalpana Srivastava**  
ICAR-Central Inland Fisheries  
Research Institute, Regional  
Centre, 26 Panna Lal Road,  
Allahabad, Uttar Pradesh, India

## Time scale changes of plankton in the river Ganga at Kanpur

**Kalpana Srivastava, Sandeep Mishra, Hari Om Verma, Venkatesh R Thakur, DN Jha, Absar Alam and BK Das**

### Abstract

The present study analyzes the long term seasonal changes in the Ganga river plankton communities at Kanpur during the period of 2002-2020. River Ganga at Kanpur is passing through multiple stressors like pollution, climate change, habitat alteration, eutrophication and various anthropogenic activities, since a long period. This was reflected by the abundant growth of various taxonomic groups of phytoplankton and zooplankton. Degradation of plankton quality was noticed by the reduction in Bacillariophyceae and increase in Chlorophyceae, with the lapse of time from 2002-2017 and 2018-2020 improvement in water quality was observed. A sudden increase in Myxophyceae was recorded after the construction of barrage in above Kanpur area during 2014 and 2015. A comparison with 1996 data indicated that river depth, temperature, Chloride, Silica, hardness and turbidity exhibited major differences in the past fifty years and impacted plankton community structures. Species shift was observed from time to time as *Synedra*, *Melosira*, *Cyclotella*, *Fragilaria*, *Nitzschia*, *Asterionella* were dominant diatoms but their order of dominance varied. Similarly, in Green algae, the present dominance of *Chlorococcales* (*Achnanthes*, *Scenedesmus*, and *Pediastrum*), replaced the dominance of *Zygnematales* (*Spirogyra*, *Monogloia*-in 1966). In recent years (2018-2020) improvement in plankton, quality is evidenced by a gradual increase of Bacillariophyceae and reduction in Chlorophyceae.

**Keywords:** Abundance, composition, diversity, Ganga, plankton, time scale changes

### Introduction

Kanpur is an industrial city of Uttar Pradesh (India) and Ganga at Kanpur is passing through multiple stressors like pollution, climate change, habitat alteration, eutrophication and various anthropogenic activities, since a long period. Various chemicals/nutrients released by the factory effluents, industrial waste etc. had also accumulated at the river bed of Kanpur eco-region. Domestic sewage, effluents from the tannery, distillery, organic waste etc. although complicates the ecosystem of the river Ganga, by upsetting the oxygen balance through the disintegration of biodegradable material, have tremendous capacity in fertilizing the water which in turn helps in enriching aquatic biomass. Phytoplankton communities of river Ganga [1, 2] and River Yamuna [3-6] have been investigated regularly. This investigation of phytoplankton and zooplankton are focused on the time scale changes of plankton of the river Ganga at Kanpur, which may be useful to infer past environmental conditions. An improved understanding of the inherent natural variability of phytoplankton is therefore important for forecasting the extent of global change impact on aquatic ecosystem functioning. The extent of physical changes and potential for species to adapt to changing environmental conditions will greatly influence food web dynamics as the future climate warms and becomes more variable. In this backdrop present investigation of phytoplankton and zooplankton are focused on the time scale changes of plankton of the river Ganga at Kanpur, which may be useful to infer past environmental conditions.

### Materials and Methods

#### Study area

Ganga is a perennial river, originated from Gangotri glacier, 3129.12 meters above the sea level. After the covering of 220 kms in the Himalayas, it enters the plains at Haridwar and ultimately joins the Bay of Bengal, after meandering over a distance of about 2290 km in the Indo-Gangetic plains of Uttar Pradesh, Bihar and West Bengal. The Ganga is highly variable, often changing its course. It swells up enormously during the monsoon, and in the summer, it