



Water quality assessment in the ecologically stressed lower and estuarine stretches of river Ganga using multivariate statistical tool

Nitish Kumar Tiwari · Subhadeep Das Gupta · Himanshu Sekhar Swain ·
Dharm Nath Jha · Srikanta Samanta · Ranjan Kumar Manna ·
Archan Kanti Das · Basanta Kumar Das

Received: 2 August 2021 / Accepted: 28 March 2022 / Published online: 1 June 2022
© The Author(s), under exclusive licence to Springer Nature Switzerland AG 2022

Abstract Water quality of the Ganga River system is changing day by day due to multifold increase in population, especially near the banks of river Ganga, and associated exponential amplification of anthropogenic activities also played a remarkable role in it. The ecologically important lower and estuarine stretch of river Ganga comprising 7 different sampling stations, i.e., Jangipur, Berhampore, Balagarh, Tribeni, Godakhali, Diamond Harbour and Fraserganj, were selected for the study as the stretch is enriched with the vast number of floral and faunal diversity. The study was conducted for a period of 5 years, i.e., from 2016 to 2020. In the study, various analytical tools and techniques were used for the assessment of riverine water quality, i.e., for calculation of water quality index (WQI); The National Sanitation Foundation Water Quality Index (NSF-WQI) and the Canadian Council of Ministers of the Environment Water Quality Index (CCME-WQI) were used for the assessment. Along with WQI various statistical univariate as well as multivariate analytical tools like principal component analysis, correlation, ANOVA, and cluster analysis were also used to achieve the desired outputs. In the study, it has been observed that NSF-WQI varied from 61 to 252, in which the higher value of NSF-WQI denoted

the unsuitability of the water quality concerning the drinking water standards and vice versa. The CCME-WQI represented a similar trend as that of NSF-WQI, as it varied from 18 to 92 in which the lower value denoted degradation in the drinking water quality and vice versa. The study revealed that the Diamond Harbour-Fraserganj stretch is having an undesired level of water quality which were analyzed based on the drinking water guideline values of the Bureau of Indian Standards and that of NSF-WQI and CCME-WQI.

Keywords Ganga River system · NSF-WQI · CCME-WQI · Multivariate analysis · Transboundary River

Introduction

Ganga river system is India's largest and world's fifth-largest river which flows an approximate path length of 2525 km, draining through five important states of the country, viz., Uttarakhand, Uttar Pradesh, Bihar, Jharkhand, and West Bengal. It is a livelihood provider for more than 400 million people, i.e., for approximately 40% of the country's population, through tourism, drinking water, sanitation, irrigation, fisheries, travel, hydroelectricity, and recreation (Singh et al., 2019; Trivedi, 2010). Due to its great religious as well as socio-economic and socio-cultural importance, the river Ganga is regarded as a soul purifier (Ramakrishnan, 2003) and is the major source

N. K. Tiwari · S. Das Gupta · H. S. Swain · D. N. Jha ·
S. Samanta · R. K. Manna · A. K. Das · B. K. Das (✉)
ICAR - Central Inland Fisheries Research Institute,
Barrackpore 700120, Kolkata, India
e-mail: basantakumard@gmail.com