An Article on Seasonal Variation in Hydrobiology of River Ganga at Brijghat (J.P. Nagar), India

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Introduction

As we know that water is necessary for all the daily life activities. Ground water is used for drinking purpose, irrigation purpose. Water is also important component in regulating temperature and life on earth. Demand of water is increasing day by day with increasing number of populations. Once if water get contaminated then it cannot be restored back easily. Contaminated water spreading diseases in human beings as well as in animals also. A study on Ganga river at Haridwar concluded that water parameters such as; temperature, turbidity, BOD and TDS varies in different three seasons (Kamboj, 2019).The quality of river water as determined by its physical and chemical constituents is of great importance in determining its suitability for a certain use such as public water supply, irrigation, industrial application etc (Dwivedi and Pathak, 2007).

Brijghat is situated on the banks of River Ganga at 5 km from Garhmukteshwar. This place has emerged as a new place of pilgrimage. On Kartik Purnima in Brijghat, a huge historic fair is held on the Ganga Ghat. It is located at 28^0 48' N 78^0 06' E having population more than 50,000 and increasing rapidly. Due to rapid increase in population, industrialisation is also increasing. A large number of villages are situated on the banks of river Ganga.

River Ganga originates from the western Himalayas at Gomukh of the Gangotri glacier in Indian state of Uttarakhand . Ganga flows south to east through the Gangetic plain of North India. When the ice of this Glacier melts it forms Bhagirathi river. As the Bhagirathi river flows down the Himalayas, it joins the Alaknanda river and forming the Ganga river. The river Ganga has a length of 2,525 km. In Uttarakhand it is 110 km, Uttar Pradesh 1,450 km, Bihar 445 km and west Bengal 520 km.

The Ganga river flows through well populated regions and providing fresh water to millions of people living in those regions. It is worshipped by Hindus as the mother Ganga. The tributaries of Ganga are the Yamuna, the Ramgaga, the Gomti, the

Gandak, the Kosi and the Mahananda. River Ganga originating from The Himalayas and emptying its water in Bay of Bengal where its makes world's largest Ganges delta. The longest tributary of the Ganga is the Yamuna. It is a major right tributary of Ganga. It originates from Yamunotri Glacier near Banderpoonch peaks in the higher Himalayas. It joins the Ganga at Prayag (Allahabad). The Gandak river rises in the Nepal Himalayas. It is comprises of two streams , Kaligandak and Trishulganga. It joins the Ganga at Sonpur near Patna. The Ghaghara river is the smallest tributary originates in the glaciers of Mapchachungo. It has three tributaries Tita, Seti and Beri. After collecting the water from its tributaries it comes out of the mountain. The river Kali ganga joins it and finally meets the Ganga at Chhapra. The river Ramganga rising in the Garhwal hills flows through the Shiwalik and enters the plains and finally joins the Ganga at Kannauj. The Gomti river originates from Gomat taal in Pilibhit, India. It extends 600 miles through Uttar Pradesh and meets the Ganga near Saidpur (Distt. Ghazipur). The Mahananda river rising in the Darjeeling hills it joins the Ganga as its last left bank tributary in west Bengal.

Utilizable water is very limited, for the human consumption, on the Earth. Water is a medium for the various chemical reactions (catabolism and anabolism) in the body of living organisms. These chemical reactions are essential life processes, such as digestion, absorption, assimilation, excretion, synthesis etc. Water molecules have cohesive property between them that help in such processes. Other daily life activities are also regulated by water like regulating body temperature. Aquatic animals are totally depend on water for their life as they uptake oxygen from the water (dissolved oxygen).

Water quality is getting deteriorate day by day due to many harmful substances discharged in it. Major source of river water pollution/ contamination is polluted sewage directly discharged into rivers without proper sewage treatment. Sewage contain large amount of domestic oil and detergent, some household chemicals that is a source of water pollution.

Increasing industrialisation also a serious problem for the water bodies as these food and paper manufacturing factories, chemical manufacturing factories, petroleum product manufacturing industries are releasing harmful chemicals such as mercury, lead, cyanide, nitrate compounds, ammonia. Nitrates compounds are more harmful for aquatic life as nitrates cause algal growth. Algal growth is the main cause of eutrophication in aquatic environment.

Large population of India in villages depend on river and wells. River water used by people for drinking and other purposes. It is polluted by the domestic and industrial sewage, agricultural activities, biological contamination such as algae and bacteria. Even in cities also supplied water can contain many chemical or biological contaminants that can cause health issues. So we can say that the activities of human beings adversely affecting the water quality. Urbanisation and industrialisation is main cause of it, that leads to the generation of large amount of domestic waste and industrious waste. Population is increasing year after year as well as demand of water is also increasing. Only 2.8% water

is available for human consumption on the earth. It is very important to clean the quality of water for future use.

As we know the melting glaciers (rivers) are the main source of water for industries, agriculture, aquaculture and domestic use. In India rivers are the main important source of water, but river pollution is now a serious problem globally.

Matta, G et al. **(2020)** carried out a study on water quality assessment using NSFWQI, OIP and multivariate techniques. NSFWQI and OIP elicit the water quality in good and acceptable class for upstream sites (Gangotri and Uttarkashi) during winter and summer season, whereas slightly pollution was reported for downstream site (Jatwara bridge, Haridwar) during monsoon season. **Jhariya, D.C.** et al. **(2020)** worked on purity and pollution of Ganga river and concluded that Ganga is now one of the India's most polluted rivers. **Kumar, V.** et al. **(2020)** worked on water quality of river Beas. Study revealed that WQI of the river Beas at Harika, before confluence with river Satluj, and at Goindwal sahib is better than at the Beas bridge. This may be attributed to self purification of the water. Season wise, water quality during the pre monsoon season was slightly better, this may be due to fast degradation of organic matter in river during summer season. River Beas is relatively less polluted than river Satluj. **Sharma, R.** et al. **(2020)** did analysis of water pollution using different Physiochemical parameters and concluded that the WQI of the Yamuna river in 2017 was the highest in collection to the subsequent years. This must have set the alarm bells ringing for the government and the citizens. The trend forecasting varified whether the exceptional tourists activity, poor sewage facilities and insufficient waste water management amenities is degrading the water of the Yamuna river at Dehradun year by year. **Singh, B (2020)** carried out an assessment of Yamuna river water quality and indicated that Yamuna river is not perfect for drinking and domestic purpose. **Kamboj, N** et al. **(2019)** carried out an assessment on pollution in riverbed mining area of Ganga River,Haridwar. The study concluded that the water quality of Ganga river recorded more polluted in monsoon season because of the high turbid runoff discharge of Ganga river as compared to summer and winter season. **Ahmad, M. (2019)** worked on water governance and suggested that water governance in the eight Indian states under study may have improved as reported by survey respondents. **Shil, S.** et al. **(2019)** worked on water quality assessment of a tropical river using WQI and concluded that the water quality of Mahananda river is generally moderate to good. The river needs protection and precautionary management plans. **Gupta, D.** et al. **(2019)** carried out a study on water quality assessment of Narmada river along the different topographical regions of the central India. It was analysed that the Narmada river water quality was poor at present and is not suitable for daily need in (pre and past monsoon) seasons. It can be concluded that the water quality of the river Narmada is poor, it needs to be treated before use. **Solanki, V.** et al. **(2019)** carried out an assessment of water quality variation of river Beas and concluded that the water quality of river is good as it enters Punjab at Talwara town, but due to

discharge of industrial effluents and sewage, it depreciates near the town Mukerian, Goindwal and Beas. **Panda, P.K.** et al. **(2018)** worked on the river pollution water in India and Abroad and concluded that the river water in India and Abroad is largely polluted with respect to physical, chemical and bacteriological pollutants, due to entry of these pollutants from various sources such as industry, mines, agriculture, urban, domestic and medicals. **Kumar, P. (2018)** carried out an assessment of simulation of Gomti river future water quality under different mitigation strategies and concluded that for the business and usual scenario, the quality status will become worse by year 2030. However, considering the scenario with mitigation measures and mentioned in local master plan for water resources management, the quality of water will improve significantly. **Singh, B.** et al. **(2018)** worked on assessment of water quality on the Yamuna river using principle component analysis. Study of PCA technique concluded that river water quality has pollution load. PCA technique is reliably method for large data analysis of surface water. **Singh, S. K.** et al. **(2018)** did qualitative study of Yamuna water across the Delhi stretch. It was concluded that, in a broader view most parameters were higher as the standard values which indicates a bad water quality. As domestic discharge causes 85% of the pollution, new waste water treatment plants both centralised and decentralised should be built. **Bora , M.**et al. **(2017)** studied the season wise variation in WQI values. Based on WQI results they concluded that effective treatment measures are urgently required to augment the river water quality by defining an appropriate water quality management plan which in turn will support any future planfor sustainable river restoration. **Diwedi, A.K. (2017)** investigated that the level of water pollution have reached to the alarming stage. The quality of water in most part of the world has degraded, though the situation in India is more severe. **Igwe, P.U. (2017)** worked on a review of environmental effects of surface water pollution. Results of the quality assessment of rivers indicated mild anthropogenic activities in terms of parameters assessed. However, if mitigation measures are not put in place, anthropogenic effects could rise beyond tolerant or permissible limits, which could affect the biodiversity. **Paul, D. (2017)** did a research on heavy metal pollution of river Ganga and suggested that various sources of heavy metals in the water and sediments of the river Ganga should be closely monitored, improvement of conditions and industrial effluent and domestic sewage discharge should be reduced. **Umamaheshwari, S. (2016)** carried out an assessment on CCME water quality index in river Cauvery. The study revealed that river water is polluted due to agricultural and industrial waste and contaminated with fecal matter. **Bhatnagar, A.** *et al* **(2016)** studied impact of mass bathing and religious activities on water quality and observed that river water of different sites showing good, medium and poor quality after religious activities. Where the water bodies are large and number of pilgrims are less, water quality is good and the water quality is poor on the small water bodies carrying heavy load of pilgrims. **Matta, G. (2015)** investigated the physico-chemical parameters of Ganga River water at

Rishikesh (Uttarakhand) and indicates that most of the physico-chemical parameters from Gangetic River System comparison to ISI and WHO for drinking water, may be suitable for domestic purposes, but it require attention due to drastic changes in climate and increase in pollution in last decade. **Shrivastava,***et al.***(2015)** worked on water quality management plan for patal Ganga river for drinking purpose and health safety. They concluded that river water is affected by industrial, domestic and public wastewater so the water of river can use only after proper treatment for drinking purpose.**Mohammad,** *et al. (***2015)** carried out an assessment on analysis of water quality using limnological studies of Wyra reservoir, Khammam District, Telangana, India. They found that water quality is within the acceptable values and water is good for drinking purpose and also acceptable for irrigation and pisciculture purpose. **Watkar, A.M. and Barbate, M.P. (2015)** worked on seasonal variations in physico-chemical properties of Chandrabhaga river in Dhapewada, district Kamleshwar Maharashtra. After study this is concluded that the water of river Chandrabhaga need proper and necessary treatment to avoid contamination of water for drinking purpose. At present the river water is suitable for irrigation and fishery purpose. **Panwar***et al.***(2015)** worked on water quality assessment of river Ganga using remote sensing and GIS techniques and observed that Ganga river water is polluted by using remote sensing technology and revealed the remote sensing technology is excellent for water monitoring in future.**Abir, S. (2014)** worked on seasonal variations in physico-chemical characteristics of Rudrasagar wetland-A Ramsar site, Tripura and concluded that the water of Rudrasagar wetland has high concentration of TSS, TDS, nitrate, phosphate etc. This high concentration shows that Rudrasagar wetland is enriched in dissolved nutrients or eutrophicated. **Sharma,** *et al.* **(2014)** studied on Effect of Mass Bathing on Water and Sediment Quality of Sagar Island Beach during Ganga-Sagar Mela. They observed that during Ganga-Sagar Mela water is polluted by faecal matter and bacterial load is also observed higher in water sample during Mela.**Gaikwad, S.S., and Kamble, N.A. (2014)** carried out an assessment of the Qualitative analysis of surface water of Panchganga river (MS). Different monitoring sites indicates the poor water quality of river Panchganga and confirmed need of necessary efforts to overcome the problem of pollution for maintenance of healthy aquatic ecosystem and its balance. **Kaur, I. and Verma, D.D. (2014)** carried an assessment on physiochemical and microbiological study of river water of Ganga an d Yamuna in Allahabad. They investigated the water of river Ganga, Yamuna and Sangam, found that water is to be above the permissible limits and various pathogenic microorganisms also isolated from these rivers water, so they concluded that the water of these rivers is not fit for human consumption without the treatment.**Salla, S. and Ghosh, S. (2014)** carried out an assessment on of water quality parameters of lower lake in Bhopal. They concluded that the lake water is highly contaminated because it receives sewage and effluents of nearby area, so the water is unsuitable for

drinking purpose and there is need for proper drainage facility to protect the water from deterioration. **Mishra, K. and Nayak, R.L. (2014)** carried out an assessment on the study of water pollution in two major rivers in Odisha- Mahanadi and Brahmani, They analyzed the status of pollution of Mahanadi and Brahmani of Odisha and concluded that the sewerage system of nearby town is polluting the Mahanadi whereas Brahmani is polluted by the steel plants and chemical factory effluents.**Katakwar, M. (2014)** studied the physico-chemical characteristics of Anjan river water in near Pipariya Madhya Pradesh. On the basis of various parameters studied, the water quality analysis indicates that the river water in the Pipariya area is polluted and can serve as a bad habitat for many aquatic animals including endangered species with Narmada River. **Mullai** *et al* . **(2013)** they worked on Monitoring of Water Quality Parameters in Uppanar River of Cuddalore District, Tamil Nadu. During this research they observed that the water of Uppanar River is polluted due to continuous discharge municipal and industrial effluents. Increase in pollution concentration leading serious problems to aquatic animals of Uppanar River. **Sahu** *et al.* **(2013)** carried out an research on Impact of Urban Wastes on the Physico-chemical Characteristics of Gomti river at Lucknow. They found that the water of Gomti river at different sites is not suitable due to the presence of heavy metals and other pollutants so there is a need for the treatment of river water before using for various purposes. **Rai, B. (2013)**carried out an project on pollution and conservation of Ganga river in modern India. According to this project report, The situation is much better for DO for which at only one site the bathing standard is not met. On the other hand in terms of total coliform count only at one place the bathing standard is met. The count exceeds by many times the bathing standard. **Eknath (2013)** worked on seasonal fluctuations of physico-chemical parameters of river Mula Mutha at Pune and their impact on fish biodiversity. He concluded that Mula-Mutha river is highly polluted due to domestic and industrial effluents. Due to high pollution in river water some species are tolerant and during winter and summer the disappearance of fish fauna is also shown. **Shrivastava, N. (2013)** they studied on deterioration of Machna river due to sewage disposal at Betul in Madhya Pradesh and it was concluded that the sewage water quality is affecting the water quality of Machna river so the water of river is not acceptable for drinking and other purposes.**Gangwar** *et al.* **(2013)** carried out an assessment of water quality index of river Ramganga at Bareilly (UP).On the basis of various parameters analyzed in this investigation, it was concluded that the water quality of river Ramganga is unfit for drinking purposes The discharging of domestic and industrial wastewater and also other anthropogenic activities were the main factors for contaminating Ramganga stream. **Kale, G.B. (2013)** worked on zooplankton diversity of Danyanganga reservoir near Khamgaon, Maharashtra. He found that the number of fishes is reduced in the reservoir because of low nutrient level in the reservoir and variations in the pH of water.**Khongwir** *et al.* ***(*2013)** worked on physico-chemical and bacteriological analysis of river Umkhrah in Shillong. They concluded that the water of

river showing maximum permissible limit of ICMR and WHO and presence *E.coli* indicated that water is polluted with fecal matter so the water of river can cause the health risks to the people. There is a need for control the pollution of river water.**Bhadula, S. and Joshi, B.D. (2012)** carried out an assessment of the impact of sewer drains on the main canal of river Ganga within Haridwar city. They concluded that rural community is responsible for the water quality degradation in Ganga river canal.**Parveen** *et al* . *(***2012)** investigated on physico-chemical properties of the water of river Ganga at Kanpur. They concluded that Ganga water of Kanpur is though fit for drinking purposes yet it need treatment to minimize the contamination especially turbidity and Fe contents. **Bhatnagar** *et al. (***2009)** carried out a research on Water Quality Indices and Abiotic Characteristics of Western Yamuna canal in Yamunanagar, Hariyana. Their study revealed the high values of various parameters such as; turbidity, conductivity, free CO_2, alkalinity, calcium, hardness, chloride. The hydrobiological conditions of the river is not optimum for survival of aquatic animals and also for domestic purpose. **Prasad, N.R. and Patil, J.M. (2008)** carried out a study of Physico-Chemical Parameters of Krishna River Water in Western Maharashtra. After the study they found that most of the physico-chemical parameters of Krishna River water are within the permissible limit of ICMR and WHO so the water of Krishna River is suitable for drinking purposes and for aquatic animals in studied period.**Sinha, D.K. and Kumar, N. (2006)** carried out an assessment on monitoring of trace metals in Gagan river water at Moradabad. according to this report, Gagan river water was found to be enriched with Zinc, Copper, Iron, Lead, micro-nutrients. These indicated a marked decrease in river water quality for trace metal studied. People exposed to river water might be suffering from the toxicity of trace metals**Samatray** *et al. (***2009)** carried out an assessment of water quality index in Mahanadi and Atharabanki rivers and Taldanda canal in paradip area, India.They concluded in their assessment that the river water of Atharabanki is polluted due to human activities and industrialization.**Ramakrishnaiah** *et al***. (2009)** carried out an Assessment of Water Quality Index for the Ground Water in Tamkur Taluk, Karnataka State. After the study of various parameters they concluded that ground water needs some degree of treatment before using for domestic and various purpose. There is also need for protect the water from contamination. **Sonawane, G.H. and Shrivastava,V.S.(2010)** worked on Ground Water Quality Assessment Nearer to the Dye user Industry they observed the drinking water of different sites is to be contaminated and not suitable for drinking purpose.**Chauhan and singh (2009)** they concluded that the water of river Ganga is not suitable for drinking purpose. Ganga Action Plan also launched by government of India for decreasing the Ganga water pollution but it failed to reduce the pollution of Ganga. From this report this is concluded that the water of river Ganga is not suitable for human beings, cattle and for wild animals.**Shivayogimath,** *et al***. (2012)** heworked on Water Quality Evaluation of

River Ghataprabha in India. They concluded that there is a gradual increase in Physico-Chemical parameters of water. This shows to keep the Water Quality parameters within the permissible limit by taking proper steps.**Akkaraboyina and Raju(2012)** did a Comparative study of Water Quality Indices of River Godavari. After this study, they concluded that water of River Godavari, at selected sites (Rajahmundry and Dowlaiswaram), is excellent to good quality and suitable for consumption.**Das** *et al. (***2013)** carried out an assessment of Ground Water Quality Index (WQI) in and around Balgopalpur Industrial Estate in Odisha. They concluded that water is not within the permissible limit so not acceptable for drinking purpose directly. Water need prpoer treatment before consumption specially for drinking purpose.**Rai** *et al. (***2011)** studied of selected water quality parameters of River Ganges at Patna, Bihar. the study indicated that increase water pollution levels in the River Ganga present near urban environment due to discharge of various types of waste water/ sewage/ effluents.**Das** *et al.* **(2013)** worked on assessment of ground water quality in and around paradeep phosphate limited at paradeep area, Odisha, India. They collected the ground water sample from different locations and investigate. Investigation shows that the water quality is good and water is fit for dinking purpose. **Agarwal and Agarwal (2013)** studied on linear regression and correlation analysis of water quality parameters was carried out in river Kosi at District Rampur in India. They concluded that the validity of regression equation that can used to find the value of one parameter if the value of other is known in same water.**Lodh** *et al.* **(2014)** researched on physiochemical studies of water quality with special reference to ancient lakes of Udaipur city in Tripura. They investigated that lakes water is receiving high number of pollutants from the surroundings so that water of lakes is highly contaminated. It is necessary to take proper steps to prevent the water from contamination. Otherwise in future the lakes water became barren biologically.**Gummadi** *et al.* **(2014)** worked on Determination of Water Quality Index for Ground Water of Bapatla, Andhra Pradesh. They analyzed that water of selected sites is safe for drinking and domestic purpose but some of the ground water of the area needs proper treatment before use. **Basawaraja***et al.***(2011)** analyzed of water quality using physico-chemical parameters Hosahalli tank in Shimoga district in Karnataka and concluded that all parameters are within the permissible limits so that the tank water is pollution free and suitable for domestic and irrigation purpose.**Bajpai, R. (2012)** did comparative study analysis of physicochemical parameters of Hasdeo river barrage and Arpa river water samples of Bilaspur river and studied that Hasdeo river water is good and within the permissible limits but Arpa river water is polluted and not fit for domestic purpose.**Kumar***et al.***(2013)** they carried out water quality assessment of river Gomti in Lucknow and concluded that water of river Gomti is polluted due to heavy metals.**Verma, S.(2009)** carried out and assessment of water quality in Betwa river at Bundelkhand region and observed that Betwa river water is polluting due to organic and inorganic pollutants of agricultural and household activities.**Jena***et al.* **(2013)**

worked on assessment of water quality index of industrial area surface water sample and investigated that surface water can be used for consumption but after proper treatment.**Sharma***et al.* **(2013)** they studied on monitoring of water quality of Yamuna river at Mathura, U.P.- physico-chemical characteristic. They concluded that water quality of Yamuna river is not within permissible limits so that river water is highly contaminated.**Khan, A.S. and Srivastava, P.(2012)** carried out an assessment on physico-chemical characteristics of ground water in and around Allahabad city and investigated that there is high concentration of salts in the ground water so it is not suitable for drinking and domestic purpose. It needs proper purification treatment before use.**Mohan***et al.* **(2014)** worked on physico-chemical analysis of bore-well water of Kurnool environs in Andhra Pradesh and concluded that water needs treatment to minimize the contamination although fit for domestic and drinking purpose.**Singh***et al.* **(2015)** studied the water quality assessment of river Ganga health hazard identification and control. They observed that Ganga river water is pollution free from Gangotri to Haridwar but there is deviation in the river water quality due to industrialization and urbanization.**Arora***et al.***(2013)** carried out an assessment on analysis of water quality parameters of river Ganga during Mahakumbh, in haridwar. They observed that there is increased value of different parameters during and after mass bathing. It highly contaminated the river water so mass bathing is main cause of contamination of river water.**Pawar***et al.***(2014)** studied on characterization of ground water using water quality index of Solapur industrial belt in Maharashtra and they observed that water is fit for drinking purpose after proper treatment.**Pandey, R.R. and Dr. Augur, M.R.(2014)** carried out an assessment on study of physico-chemical parameters of Ib river, Jashpur in chattishgarh. They observed good water quality of Ib river and river water is good for agricultural purpose.**Lamare***et al.***(2014)** carried out an assessment on ground water quality from dug wells in west Jaintia hills in Meghalaya. They found that dug well water is acidic in nature and the other parameters are within the permissible limits.**Yogendra, K. and Puttaiah, E.T.** (2008) Studied determination of water quality index and suitability of an Urban water body in Shimoga town in Karnataka. They determined that environmental parameters influenced the water quality.**Ahmad, A.B.(2014)** did evaluation of ground water quality index for drinking purpose from some villages around Darbandikhan in Iraq. He concluded that ground water is showing excellent quality of water and fit for drinking purpose without any treatment.**Parmar, K and Parmar, V.(2010)** studied on evaluation of water quality index for drinking purpose of river Subernarekha in Singhbhum district. They observed that river water is excellent to average quality so that main cause of deterioration of river water is industrial effluents, untreated sewage and unprotected river sites.

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