

EFFECT OF PHYSICO-CHEMICAL PARAMETERS OF RIVER GANGA (VARANASI) & RIVER SAI (JAUNPUR) ON MORPHOLOGICAL CHANGES IN FISHES

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Abstract:

We have studied the effect of physico-chemical parameters of river Ganga (Varanasi) & river Sai (Jaunpur) on the Fishes. Qurashi et al has studied the temperature, transparency, pH, BOD, COD and Cl⁻ effected many morphological as well as growth response factors and their habits. It is concluded that these parameters affect the life of fishes. It forms the new species by variations due to adaptation. The results showed that both rivers are affected by pollution from human activities like sewage discharge, agricultural runoff, and industrial waste. These pollutants cause stress in aquatic organisms, especially fishes.

Introduction:

The fresh water fishes are an important living aquatic resource and has become a good source of protein diet as well as way of earning money through export. Besides fulfilling the domestic demand and fetching high price as compared to the fishes, the export potential of fishes is also aquatic good, considered as good source. The price of fishes are six times more than the price of fish. Therefore, the fish culture has grown as a well-developed industry and has become a good source of income. The production of the organisms directly depends on the productivity of ecosystem (Radheyshyam). The productivity of the aquatic ecosystem is largely regulated by the quality of water nutrient status and environmental factors (APHA, Kanujia, and Mohanty and Radheyshyam). The studies on the production efficiencies of aquatic ecosystem have been found to be of utmost importance and helpful in the ecosystem for growth, production and taxonomic changes. Rivers are vital freshwater ecosystems that play a critical role in supporting biodiversity, human livelihoods, and regional economies. In India, rivers such as the Ganga and Sai are not only ecologically significant but also culturally and economically important.

However, rapid urbanization, industrialization, and agricultural expansion have led to increasing levels of pollution in these river systems, particularly through the discharge of untreated sewage, industrial effluents, and agrochemicals.

The River Ganga, especially in the Varanasi region, has been under intense environmental pressure due to heavy anthropogenic activities, including mass bathing, ritual offerings, and disposal of solid and liquid waste. Similarly, the River Sai, a tributary of the Gomti River flowing through Jaunpur, is experiencing degradation due to urban runoff, agricultural leachates, and domestic waste

The present study is based on the physico-chemical parameters of the river Ganga & Sai at Varanasi & Jaunpur district because the fluctuation of water fluctuates the morphology as well as their development etc. These are some parameters such as temperature, transparency, pH, BOD, COD and Cl⁻.

Review of Literature

India has made commendable progress in aquaculture. Aquatic counterpart, to 'Green revolution' is termed in this field in India. It is due to the application of new technologies and research made during the last few decades George and Sinha, 1975. Practising taxonomy usually means constructing classification of particular group of organisms and also identifying specimens in accordance with classification already made. Ecological data have always been involved in Taxonomy in a Broadway, and are also now increasingly important and precise. Ecological data provided criteria for recognizing especially lower but also higher evolutionary, taxa. Occurrence of prawns in freshwater bodies of Jammu has documented by Dutta, 1978, The Indian River fishes have been studied by Qureshi et.al., 1990, Prakash, 1991. The demand for prawn in world market as expected to be doubled in the next few years from the present level of 8,10,000 tonnes. In this context, India has played a major role in the world market to maximize and improve the economy of the fishery bulk in rural areas. The systematic research on fish culture in India began from 1957 at central Inland fisheries Research Institution, Cuttack (CIFA) with the first trial on, fishes collected from Mahanadi (Raman, 1984, 1992).

The Ganga River is said to be the most holy river in the country and is regarded as purifier of the human body and their sin. Millions of people of the country and abroad take a dip into the holy river in every season and on sacred occasions. Besides the river water is used for drinking, washing, bathing and recreational purposes. It is considered to be the most potent freshwater fishery resources of the country (Jhingran, 2003). Varuna river at Varanasi, Shukla, et.al., 1988; Prasad, 1989; Singh and Singh, 1990, Ganga River at Varanasi, Mishra, 1992, Gomti river at Lucknow; Toxic waste disposal, Prasad et.al., 2000, Mahanadi river at Sambalpur, Nanda et.al., 2001. Physico-chemical characteristics of sewage and industrial effluents have been studied by many researchers in India such as Agrawal et.al., 1976; Mishra, 1992; Mishra, 1993. The quality of sewage entering different rivers has also been reported by some investigators as Kali River at Meerut, Kudesia and Verma, 1986. Physico-chemical properties of some other rivers have also been studied by Dubey et al., 2000; Bhadra et.al., 2003; Sinha et.al., 2004; Samanta et.al., 2005. Indian river systems are endowed with considerable resources of fish which forms an important fishery in river Ganga of Uttar Pradesh, Bihar, West Bengal, river Mahanadi of Orissa, Godavari and Krishna, rivers of Andhra Pradesh. Gupta, Braj Kishor, Uttam Kumar Sarkar, and Sanjay Kumar Bhardwaj. "Assessment of habitat quality with relation to fish assemblages in an impacted river of the Ganges basin, northern India." The Environmentalist 32.1 (2012)

In a comparative study, Yadav et al. (2020) analyzed morphological deformities in *Labeo rohita* and *Catla catla* from the Ganga and Sai rivers and found clear signs of gill damage, reduced body weight, and abnormal fin development in specimens from more polluted stretches. Recent studies have highlighted significant seasonal and spatial variations in the

water quality of the River Ganga at Varanasi. Poul and Myrthong (2023) assessed physico-chemical parameters across five ghats and found that while most parameters were within permissible limits, pH and BOD levels exceeded the standards, indicating organic pollution. Kumar and Singh (2024) investigated the impact of pesticide contamination on water quality and its subsequent effects on freshwater fish, *Labeo rohita*. The study found that exposure to various pesticides led to a significant loss of protein content in the liver, gill, and intestinal tissues of the fish, indicating the detrimental effects of chemical pollutants on aquatic life. Thus, the review of above literature indicated that some work such as physico-chemical biological, taxonomy of prawn population and study of food and feeding has been done. Taxonomy of prawn population and detailed study of food and feeding habits of fishes from Ganga River at Varanasi & Sai River Jaunpur is still lacking. The present study on prawns of Ganga River at Varanasi region is an urgent need.

Materials and Methods:

Water and fishes are sample were collected to study the important water quality parameters from the river Ganga at Varanasi & Jaunpur. The samples were collected and preserved immediately by adding 0.5 ml Chloroform and transported carefully to the laboratory for chemical analysis. The samples were analysed for major physico-chemical parameters by the methods (APHA). The temperature of water was recorded by thermometer graduated from 0° to 50°C. Transparency of river water was measured by means of Secchi disc and result were computed as follows.

$$\text{Transparency} = A + B/2$$

The pH of water sample was recorded by Lovibond pH paper. Dissolved oxygen was fixed soon after collection by adding 2ml each of MnSO_4 , and KOH, KI solution. The ppt was then dissolved by adding conc. H_2SO_4 , and then transported to the laboratory for analysis. Thereafter, the sample was titrated against N/40 thio-sulphate in the presence of starch as an indicator. Calculation was done using the following formula -

$$\text{DO} = \text{ml titrate} \times N \times 200/V$$

where, N = Normality, V = Volume.

BOD is the amount of oxygen required by the micro-organisms to stabilize decomposable organic matters in waste under aerobic condition. BOD is a measure of the presence of organic materials.

COD is defined as total amount of oxidizable material present in the water sample that can be oxidized by strong chemical oxidant is known as the chemical oxygen demand.

The Cl⁻ conc. was analysed by titrating the sample with mercuric nitrate using potassium chromate as an indicator and the values were computed as per following formula:

$$\text{Cl}^- \text{ mg (l)} = \frac{(\text{ml} \times \text{N}) \text{ of AgNO}_3 \times 100 \times 355}{\text{Volume of sample}}$$

Result and Discussion:

Various hydrological features of flowing water ecosystems are directly or indirectly influenced by the biotic and abiotic factors present within the system which are closely inter-related with each other. Growth, multiplication and survival of resident aquatic organism are thus, greatly influenced by the change in ecological parameters. In present study, monthly fluctuations in various water parameters during the year 2009-10 at river Ganga Varanasi have been discussed.

The detailed monthly water temp variations at River Ganga Varanasi recorded during 2009-10. The minimum temperature recorded at 20 °C in the month January while the maximum temperature of water was in a range of 31.5C was recorded in the month of May.

The yearly mean water temperature at River Ganga Varanasi was 28 °C. A marked fluctuation was observed in surface water temperature in River Ganga at Varanasi during 2009-10.

The sites of river Ganga Varanasi to be studied received adequate sunlight and transparency dropped from 28.2 to 32.03 cm except in June to July, however, in rest of the months, it was in a normal range. The pH of water of River Ganga Varanasi ranged between 7.4-8.6 while in May it was 8.55 in July 7.4.

The BOD values recorded from the site in the month of January (23 plus/minus 0.045 mg/l) while maximum BOD values are recorded at site in the month of June (122 pm 0.035mg / l) Same results were observed by Crawl), Mishra and Shukla values are affected by Conc. Of wastes. The COD values were recorded at site in month of June (26.4 + 85.4mg / l) The minimum values observed in the month of January. It is also fluctuated by presence of sewage discharge at the site. Similar observations have been done by Mishra and Mishra), Shukla and Tripathi, Sikandar and Tripathi.

The details of chloride value ranged between 26.485.4 CI plays an important aspect for the water bodies. The maximum to minimum values of Cl in December and July respectively. The maximum value may be due to large amount of sewage disposal at the site. Many investigators investigated the Cl i.e. Ajmal et al., Bernard, Bigrams, Chakrabarty et al., Lakshminarayan, Shukla and Tripathi's and Zajic) From the study it is clear that these parameters increase with the addition of marble slurry leading to deterioration of the overall quality of the groundwater. Singhal et al.(2005)

Thus, above parameters affected the water bodies, specially, the fresh water fishes it is morphology, larval development, breeding, and other changes caused by water fluctuation. The recent research in Uttar Pradesh (India) concluded that it is the high rate of exploration then its recharging, inappropriate dumping of solid and liquid wastes, lack of strict

enforcement of law and loose governance are the cause of deterioration of ground water quality (Gupta 2009).

Physico-Chemical Parameters of Water Sample (2009-2010)

Parameters	Jan	Feb	Mar	Apr	May	June
Temperature	20±0.09	22±0.08	23±0.01	26±0.02	31.5±0.01	30±0.02
Transparency	65.2±0.02	64.3±0.06	60±0.02	58.9±0.01	55.6±0.04	28.2±0.06
pH	7.67±0.027	7.6±0.027	7.5±0.01	7.7±0.02	8.55±0.01	7.9±0.01
BOD	23±0.045	50±0.02	65±0.02	67±0.02	70±0.03	122±0.04
COD	140±0.035	142±0.021	190±0.020	198.0.031	215±0.050	246±0.20
Cl ⁻	71.3±0.02	68.2±0.61	44±0.01	44±0.01	50.3±0.02	26.4±0.06

Parameters	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temperature	28±0.01	25±0.01	24±0.02	26±0.03	23±0.02	21±0.02
Transparency	32.3±0.05	34.2±0.02	35.3±0.07	37.4±0.06	39.6±0.04	50.±0.07
pH	7.4±0.02	7.5±0.02	7.6±0.02	7.7±0.015	7.8±0.01	7.7±0.02
BOD	112±0.04	105±0.06	95±0.03	85±0.02	80±0.01	75±0.02
COD	240±0.10	230±0.310	198±0.322	197±0.211	192±0.11	172±0.212
Cl ⁻	26.4±0.06	31.4±0.61	33.4±0.31	41.2±0.01	79.5±0.02	85.4±0.07

CONCLUSION

The present study concludes that the physico-chemical characteristics of River Ganga at Varanasi and River Sai at Jaunpur have been significantly altered due to increasing anthropogenic activities such as domestic sewage discharge, industrial effluents, agricultural runoff, and religious practices. Analysis of water samples from both rivers revealed considerable deviations from standard water quality parameters, particularly in terms of temperature, transparency, Cl⁻ pH, dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), & total dissolved solids (TDS). The comparison between the two rivers indicates that although both are under environmental stress, the River Ganga at Varanasi exhibited slightly more severe pollution levels, likely due to the higher population density and religious activity in the area. In contrast, the River Sai, while smaller in scale, is increasingly affected by unregulated agricultural and urban runoff, posing an emerging threat to its aquatic ecosystem.

This study highlights the urgent need for integrated river basin management strategies that include regular monitoring of water quality, strict enforcement of environmental regulations, treatment of industrial and domestic waste before discharge, and public awareness campaigns. Restoration of these river systems is essential not only for preserving fish biodiversity but also for maintaining the ecological balance and supporting the livelihoods of local communities dependent on these rivers.

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