Journal of Advanced Laboratory Research in Biology
E-ISSN: 0976-7614
Volume 5, Issue 3, July 2014
PP 102-106
https://e-journal.sospublication.co.in

Research Article

Hydrobiological studies in river Burhi Ganga in district Etah (U.P.), India

Mukesh Chandra*, Saxena R.S. and Sharma H.N.[1]

P.G. Department of Zoology, Ganjdundwara P.G. College, Ganjdundwara, Etah, U.P., India.
[1]*Department of Environmental Toxicology, School of Life Science, Dr. B.R. Ambedkar University, Agra-282002, U.P., India.*

Abstract: Water pollution is a major problem today. Excessive agricultural chemicals like fertilizers and pesticides, sewage and industrial effluent runoff in rivers and pollute aquatic ecosystem. It in turns affects the aquatic fauna and flora and water quality also. In the present study, quality of Burhi Ganga river water has been tested on the basis of some hydrobiological parameters like water hardness, total solids and dissolved oxygen.

Keywords: Hardness, Total solids, Dissolved oxygen, Water pollution.

1. Introduction

Freshwater bodies are among the most productive, life support system in the world and are of immense ecological importance for the survival of natural biodiversity. By Virtue of natural functioning, they play a very important role in the improvement of water quality, removal of sediments, production of oxygen, recycling of nutrients and controls of flood etc.

Thus, freshwater ecosystem, if managed properly can support freshwater fisheries in the country, providing a livelihood to a large number of fishermen and rural population and therefore contributing significantly to the total inland fish production.

About 70% of the earth's surface is covered with water, contributing less than 3% of freshwater and the rest is marine or salt water (Wetzel, 1983). According, to Odum (1983) freshwater habitats occupy relatively a small portion of the earth's surface, but its importance is far greater than their actual area. Man has been exploiting this valuable resource directly or indirectly since time immemorial for drinking, bathing, agriculture, fishery, aquaculture and recreation etc.

Thus, water is an integral constituent of life and one of the most important natural resources. Water has been serving receptacle for all kinds of wastes since man has evolved, but the impact of such user was not much pronounced in the past. Today, our all water resources have become polluted due to anthropogenic pressure and scientific development.

Importance of rivers in maintaining health as well as a prosperous nation in a healthy environment is amply recognized from the very existence of civilization (Welch, 1952). However, in the lust of modernization and increasing industrialization, urbanization, agriculture and other human activities have caused enormous deterioration in the quality countries like India. In spite of considerable self purification capacity of rivers, unabated disposal of municipal and village sewage and industrial effluents are deteriorating the quality of river water. The limit of sewage concentration that a water body can carry without any deleterious effect is very low. Due to the increase of organic matter, the material is oxidated liberating carbon dioxide and other toxic gases in freshwater bodies, as a result, there is a drastic reduction in oxygen content of water (Kendeigh, 1980).

According to a survey conducting by NEERI, it was revealed that more than 80% of available water in India is polluted. The problem of pollution has increased in last 50 Years. Commoner (1976) has stated that the environment in the past was almost pure, virgin and unused, but today most of the rivers have become polluted to a great extent by domestic sewage and industrial wastes (Ajmal *et al.*, 1984; Kar *et al.*, 1987; Shukla *et al.*, 1989; Sinha *et al.*, 1989 & Singh *et al.*, 1996).

Thus, the pollution of Indian River, if goes beyond certain limits than the cost of water treatment in the maintenance of water quality, becomes an extra burden

*Corresponding author:
E-mail: harendra_n_sharma@yahoo.com.

on the economic condition of the country. This may adversely affect all the user of water, such as domestic, agricultural, aquacultural, industrial, including hydropower production and other requirements of human settlement. Fast changing nature, intensity of human activity and pollution load generated in the basin is an important aspect to formulate pollution control programs and policies. Thus, great and urgent need for such a study in India qualifies itself, beyond doubt in the national interest.

A proper development and extension of fishing programs assume greater significance since they add much not only to the welfare of the rural population engaged but also to the well being of the districts as Etah is economically and industrially backward district of Uttar Pradesh.

Fortunately, district Etah has plenty of water resources ideal for fishery or underwater agriculture. Besides Ganga the other freshwater bodies suitable for fishing exercise are in the form of small seasonal rivers like Burhi Ganga, Kali, Esan, Aring, Kari, Neem, Sengar some lakes like Dariyabganj Jheel in Aliganj tehsil, Patna Jheel in Jalesar tehsil and Rustumgarh Jheel in Marhera town of Etah district and more than twenty large sized major ponds.

The fish production in Burhi Ganga is also fast depleting due to improper methods of fishing and fish marketing and pollution caused mainly by sewage and dense of submerged and surface macrophytes. Thus, the need for ecobiological studies for freshwaters is more conspicuous than ever before, because the freshwater ecosystem is most indiscriminately exploited in Etah district.

2. Materials and Methods

2.1 Selection of site

The Burhi Ganga has been one of the most prominent and sacred rivers of India through ages. The prime objective of any analytical monitoring program is to obtain analytical data, which clearly depicts the system being studied. Thus, the basic objective of analysis of various types of water sample and blood sample of fishes collected is to assess the potential in a region taking into consideration both quality and pollution aspects due to pollution.

Site-A: Pratappur village;
Site-B: Kader Ganj and;
Site-C: Nardauli village.

In addition to these, there are numerous cremation grounds near the bank of the river, which also contribute towards pollution. It is not only these places that contributed to the wastes, but also the colonies and industrial units that are present around or in the near vicinity of the river.

2.2 Experimental protocol

The proposed work has been taken to study the hydrobiological properties of river Burhi Ganga in Etah district. To study hydrobiology at least three sampling stations *viz*. A, B, and C will be set up in some distant places as per map, from where water samples will be collected monthly to study hydrobiological properties.

2.3 Collection of water samples

The sample is usually only a small part of the total volume and is representing the total mass only to the degree of uniformity of chemical composition. In their natural state, surface and groundwater are subjected to forces that promote mixing and homogeneity. The chemical quality of surface water is the resultant of the geologic, hydrologic, biologic and cultural environment of the water and varies from time to time as well as from place to place.

Care is taken to obtain a sample that is truly representative of existing conditions and to handle it in such a way that it does not deteriorate or become contaminated before it reaches the laboratory. The details of collections vary so much with local conditions that no specific recommendation would be universally applicable.

Sampling at the first stage was performed to study the variability in the physical conditions and chemical characteristics used as a measure of water quality. Collection of water samples was made for the period year 2012-2013 at 15 days interval. The water samples were collected at the depth of six inches below the river surface. Separate samples from three sampling sites A, B, and D were collected for the measurement of various components of water.

The water sample was collected by simply dipping up the container below the surface of the water (6" to 8" depth) without formation of bubbles and then de-slopperings the same, when the bottles get completely filled against the direction of the flow of water, the bottles were stoppered and taken out from the stream.

An important factor affecting the result is the presence of turbidity, the physical and chemical changes from the time of storage or aeration prior to analysis and the method used for its removal. Temperature, pH changes are significant in a matter of minute. Dissolved gases may be lost or gained. Therefore, these determinations were carried out at the experimental site.

Immediately after the collection of the samples, it was made possible to measure the water quality nonspecific characteristics such as pH and temperature. Measurement of the other characteristics subject to physical or chemical changes was subsequently followed. Standard methods (APHA, 1989) were employed to preserve the sample, at least for 24 to 36 hours. The analysis was completed without further delay.

In case of wastewater samples, it was considered necessary to prevent the possible physicochemical changes. Accordingly, samples were kept in a frozen state (0-4^{0}C) to inhibit such changes.

It is also highly desirable to seal the water sample bottle carefully prior to its transport to the laboratory. A minimum to time elapses between collection of water samples and analysis should occur and the bottles once opened, the sample should be analyzed as soon as possible.

Analytical procedures mentioned in Standard Methods for the examination of water and wastewater were followed for the measurement and estimation of various parameters reported in this thesis. All, the reagents and colorimetric solution were prepared and purified according to these procedures. Reagents were prepared by using A.R. Grade Chemicals.

2.4 Hardness

Temporary hardness is caused by the presence of bicarbonates of calcium and magnesium and permanent hardness (non-carbonate hardness) is mostly due to sulphate. It is analyzed by EDTA titrimetric methods of Barnard *et al*., 100ml of water sample was taken into 250ml Erlenmeyer flask. 1ml ammonium buffer and 3 drops of Eriochrome black t indicator was added and then titrated with an EDTA solution until the color changes from red to blue. The hardness was calculated as below:

$$\textbf{Temporary hardness (mgl}^{-1}\textbf{)} = \frac{\text{ml of EDTA}}{\text{ml of water sample}} \text{ X } 1000$$

2.5 Total solids

Total solids were determined by the addition of dissolved and suspended solids.

2.5.1 Suspended solids

To determine the suspended solids, 100ml sample was filtered through Whatman's no. 1 filter paper which was previously weighted and then kept the filter paper along with the filtrate into the oven up to dryness. The value was then calculated as under:

$$\textbf{Suspended solids (mgl}^{-1}\textbf{)} = \frac{(\text{A}-\text{B}) \text{ X } 1000}{\text{ml sample}}$$

Where A = weight of filter paper with suspended solids (mg) and B = initial weight of filter paper (mg).

2.5.2 Dissolved solids

Dissolved solids were estimated with the help of hydrometer; 1.25 liter filtered water was taken into a cylinder and the hydrometer was dipped into the sample. After the stagnant position of the hydrometer, the reading was noted and calculated with the help of calibrated table in mgl^{-1}.

2.6 Dissolved Oxygen

For the analysis or oxygen dissolved in water, the sample is taken out from the sampling bottle with the help of the rubber siphon into separate airtight glass stoppered bottles of 250ml Capacity. Utmost care and precautions are taken to avoid bubbling so that atmospheric oxygen is not diffused inside the bottle containing the sample water.

3. Results and Discussion

Hardness of water is understood to be a measure of the capacity of water to precipitate soap. The magnitude of pollution in any aquatic system is marked by hardness of water. It is chiefly due to the presence of Ca^{++} and Mg^{++} ions, but Fe^{++}, Cu^{++} and Zn^{++} also showing same correlation with hardness. Sharma *et al*., (1981) observed that the high pollution load discharged by sewage drain into the river water is directly related to the hardness of water. Hardness of the river water is of considerable significance in connection with the discharge of the sewage effluents containing pollution as indicated by the variation in the concentration of the hardness of water. During, the present investigation the hardness were maximum in summers (962.3mg/l) and the minimum in monsoon respectively; while minimum (539.6mg/l and 634mg/l) in August 2012 and 2013.

The low values of hardness in rainy season were mainly due to the addition of rainwater and the high concentration of the hardness in the river due to a large reduction in flow and proportionately greater effect of the sewage effluent flow in the river. These findings gain support by Rai (1974), Singh and Singh (1990) and Patel and Patel (1993). The water having higher hardness value causes heart diseases (Reter, 1974).

Total solids in water are composed mainly of carbonates, bicarbonates, chlorides, sulphates, phosphates and nitrates of cation like Ca, Mg, Na, K, organic matter, silt and other partied. In polluted water, the increase in the concentration solids depends upon the type of pollutants. The suspended matter in the aquatic system considered as suspended solids and dissolved solids in the water. The total solids are one of the major pollutional parameters as it shows an increasing affinity with the pollutional condition. Prasad and Saxena (1980) and (Verma *et al.*, 1977) David and Ray (1966) stated that solids may change the osmotic regulation and caused suffocation to fish in the high dissolved oxygen.

In the present study, it was noted that the total solids were high in monsoons (1756.3mg/l and 1936.4mg/l) in the year 2012 and 2013 respectively but appreciably high amount was also present in winter summer and autumn. In spite of this fact, water turbidity was recorded low in summer, winter and autumn, which may be because of the gradual sedimentation of suspended solids in the bottom of the river due to the reduced flow of water which favoured the effective sedimentation. Prasad and Saxena (1980) stated that pollutional load is directly related or proportional to dissolve solid. A significant positive correlation, i.e. +0.796 was observed by Mittal (1988) during the assessment of Karwan river water quality.

According to David (1956) Rana (1982 and 1995) and Singh and Ghosh (1999) total increase in monsoon, when loading of the soluble salts from the catchments area increases as a result of the surface runoff.

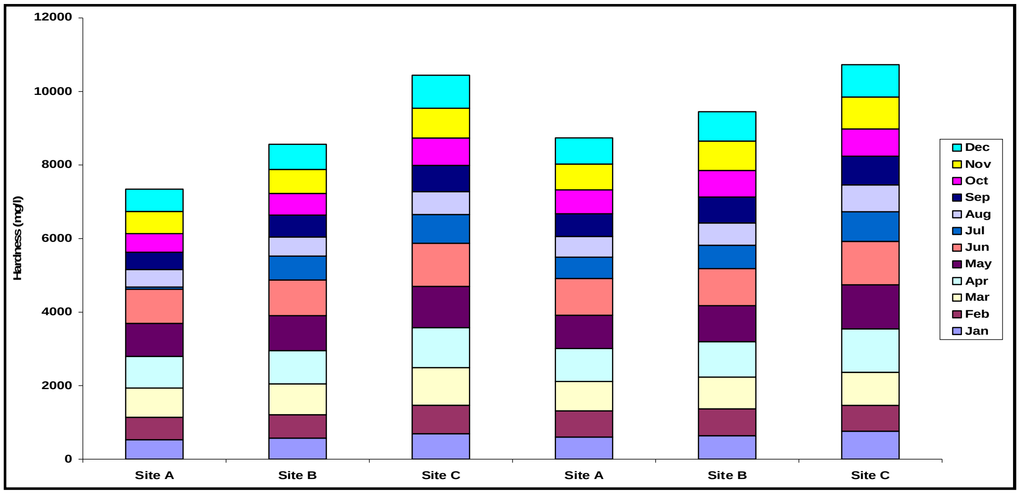

Fig. 1. Monthly Variations in hardness (mg/l) at three sites in river Burhi Ganga.

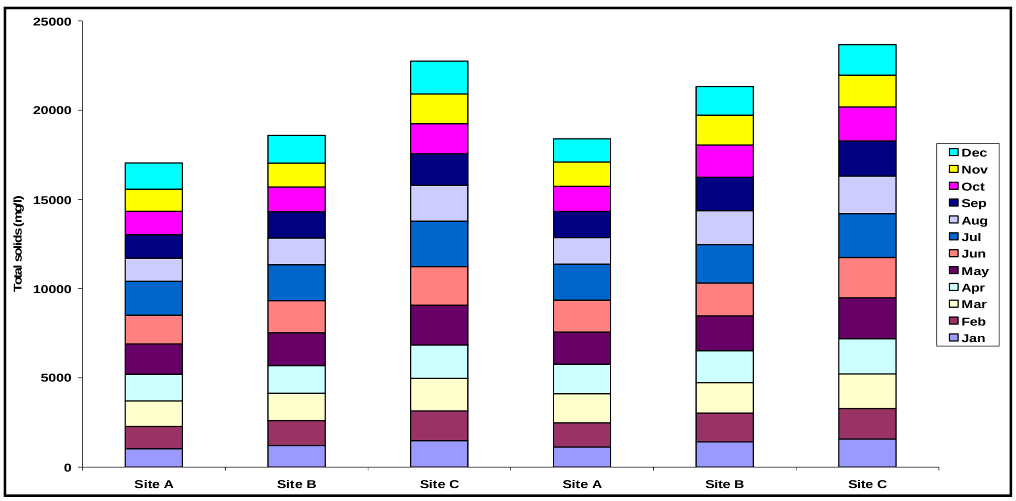

Fig. 2. Monthly Variations in Total solids (mg/l) at three sites in river Burhi Ganga.

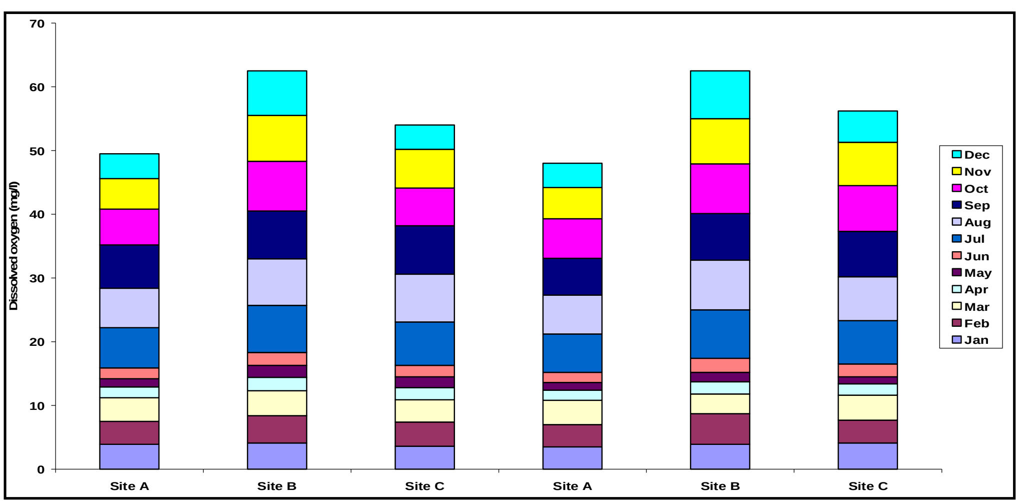

Fig. 3. Monthly Variations in dissolved oxygen (mg/l) at three sites in river Burhi Ganga.

Dissolved oxygen is one of the foremost important chemical factors in an aquatic environment as fish and their food (plankton) depends on the dissolved oxygen. Oxygen gets dissolved in water almost continuously at the surface, where the air has indirect contact with water. In the natural water resources, the concentration of dissolved oxygen depends on the chemical and biochemical phenomenon. The dissolved oxygen deficiency mostly occurs in the summers, which directly affect the aquatic ecosystem of the river due to biomagnifications and bioaccumulation (Birge, 1916; Rai, 1973; and Rana, 1996).

In the present investigation, the maximum DO (7.2mg/l) concentration was noted in the rainy season and minimum 2.1mg/l in the summers. The highest concentration of the dissolved oxygen during the periods of low temperature is in conformity with the general conception that the solubility of this gas in water is more at low temperature. The highest concentration of dissolved oxygen was due to the low water temperature and considerably high growth of algae, which release appreciable amount of oxygen as a result of photosynthetic activities (Sangu and Sharma, 1985). Dissolved oxygen contents were influenced by the photosynthetic and respiratory activities of the flora and fauna of the river. The minimum dissolved oxygen in the monsoon might be due to the retarded photosynthetic activity of phytoplankton and consumption of oxygen by the dissolved organic matter in water by Chopra *et al*., (1990). The low dissolved oxygen value may be firstly due to the higher water temperature at which its release oxygen in the atmosphere (Ellis, 1937; Elmore, 1961) and secondly by the active utilization by microorganisms in the decomposition of organic matter (David, 1956 and Saxena *et al.*, 1966). However, the dominance of zooplankton over phytoplankton was responsible for depletion of oxygen on account of their respiratory demand. Dissolved oxygen level as formed in the Burhi Ganga River is particularly indicator of organic matter input into it.

References

[1]. APHA (1989). Standard methods for the examination of water and wastewater. 19th Ed., American Public Health Association, Washington, D.C.

[2]. Chopra, A.K., Madhwal, B.P., and Singh, H.R. (1990). Abiotic variables and primary productivity of river Yamuna at Naugaon, Uttarkashi, Garhwal. *Indian J. Ecol.*, 17(1): 61-64.

[3]. David, A. and Ray, P. (1966). Studies on the pollution of river Daha (N. Bihar) by Sugar and Distillery wastes. *Environ. Hlth*, 8(1): 6-35.

[4]. Kar, S.K. (1979). Malformation at birth in the saltwater crocodile (*Crocodylus porosus* Schneider) in Orissa, India. *J. Bombay Nat. Hist. Soc.*, 76: 166-167.

[5]. Mittal, S. and Sangar, R.M.S. (1968). Quality of Karwan river water entering Yamuna at Agra, Mendel. 5(4): 316-321.

[6]. Odum, E.P. (1953). Fundamentals of ecology. Philadelphia: W.B. Saunders Company. 383 P.

[7]. Patel, M.K. and Patel, T.K. (1993). Assessment of water quality in the rivers of Western Orissa: Part I: River Sankh. *Indian J. Environmental Protection*, 13(12): 909-916.

[8]. Rai, H. (1974). Limnological studies on the river Yamuna at Delhi, India. Part-I: Relation between the Chemistry and the state of pollution in the river Yamuna. *Archiv. Hydrobiol.*, 73(3): 369-393.

[9]. Rana, K.S. (1994). Assessment of pollution in river Jammu and its impact on fishery biology and public health. D.Sc. Thesis, Agra University, Agra.

[10]. Rana, K.S. (1996). Assessment of pollution in river Jamuna. Part II Phytoplankton. *Nature Env. and Poll. Technology*, 13(2): 41-48.

[11]. Sangu, R.P.S. and Sharma, K.D. (1985). Studies on water pollution on Yamuna River at Agra. *Indian J. Environ. Health*, 27(3): 257-261.

[12]. Sharma, K.D., N. Lal and P.D. Pathak (1981). Water quality of sewage drains entering Yamuna at Agra. *Ind. J. Environ. Hlth.*, 23(2): 118-122.

[13]. Shukla, S.C., Tripathi, B.D., Kant R., Depa, K.V. and Pandey, V.S. (1989). Physicochemical and biological characteristics of river Ganga from Mirzapur to Ballia. *Indian J. Environ. Hlth.*, 31(3): 218-227.

[14]. Singh, A.P. and Ghosh, S.K. (1999). Water quality of river Yamuna. *Poll. Res.*, 18(4): 435-439.

[15]. Sinha, A.K., Srivastava, K. and Sirivastava, K.N. (1994). Water Quality Index of River Sai at Rai Bardi. *Indian J. Environmental Protection*, 14(2): 888-890.

[16]. Upadhyay, R.K. and Rana, K.S. (1991). Pollutional status of river Yamuna at Mathura. *Nat. Environ.*, 8(2): 33-37.

[17]. Verma, S.R., Tyagi, A.K. and Dalela, R.C. (1977). Studies on the characteristics and disposal problems of industrial effluents with reference to I standard Part-II. *Indian J. Environ. Health*, 19(3): 165-175.

[18]. Welch (1948). Limnological Methods. McGraw-Hill Book Co. Inc. New York.