ISSN: 2347-5129
IJFAS 2014; 1(3): 205-208

www.fisheriesjournal.com
Received: 30-12-2013
Accepted: 04-02-2014

Dr. Radha Krishna
PGT Biology, Air Force School Bamrauli Allahabad, Uttar Pradesh, India

Correspondence:
Dr. Radha Krishna
PGT Biology, Air Force School Bamrauli Allahabad, Uttar Pradesh, India

Water quality of Gomati River at Sultanpur city, U.P

Dr. Radha Krishna

ABSTRACT
The physico-chemical characteristics of the water from the Gomati River, including temperature, pH, DO, FCO2, alkalinity, hardness, TDS, BOD, COD, chloride, nitrate, and sulphate, revealed seasonal fluctuations. The majority of the river's characteristics in Samastipur Town are acceptable and conducive to fish growth and development, however some pollution-indicating indicators, particularly TDS, BOD, and COD, were found to be higher than the WHO-recommended tolerance limit.

Keywords: Gomati River, Physico-chemical parameters

1. Introduction
Due to its importance in promoting both human and ecosystem health, water is a primary focus of environmental quality. Water is necessary for life on our planet, but it is getting harder to get and is in risk. Water quality and availability have always been crucial elements in defining the quality of living. Seventy percent of the earth's surface is covered by water in the form of rivers, lakes, streams, seas, and oceans, all of which are essential to the life cycle (Arimieari *et al*., 2014) [3]. Only 3% of the liquids that make up 70% of the earth's surface are classified as fresh water, and only 5% of this fresh water, or 0. 15% of all water on Earth, is used for useful activities (Usharani *et al*., 2010) [21].
For all life to exist, rivers are essential and delicate freshwater systems. On the other hand, the deteriorating water quality in these systems threatens their long-term viability and is a cause for concern. Around the world, rivers are significant waterways that provide necessary water supplies for domestic, industrial, and agricultural use. A healthy aquatic ecosystem is crucial for ecological balance and agriculture, which depend on the good physico-chemical characteristics of water. Water from this river is used by locals in and around Sultanpur for a variety of purposes, such as irrigation, bathing, washing, and drinking. Along with these human activities, domestic sewage is dumped into the river. The water's quality has therefore declined. Only a few rivers still have their native chemistry due to the industrial revolution, which has drastically altered it.
There is currently a shortage of baseline data on the physicochemical properties of the river Gomti in Sultanpur city, despite the fact that many researchers have studied the physicochemical and biological aspects of fresh water bodies, such as Prakash *et al*. (2002). As a result, the current study was started to look at the Gomti River's water quality in Sultanpur. The study's objectives included looking into the possibilities for better management and development as well as improving the river's water quality.

Materials and Methods
Study Site
The Gomtai River, commonly known as Aadi Ganga, is a tributary of the Ganges. It starts off as a small reservoir called "Gomat Tal," which is located about 32 kilometres to the east of the district of Pilibhit, and it joins the Ganga between Varanasi and Gazipur about 200 metres in height
Between the rivers Ramganga and Sharda in the upper stages and Ganga and Ghaghra in the lower reaches, the river drains this region. It flows through the districts of Lucknow, Barabhanki, Sultanpur, Faizabad, and Jaunpur before merging with the Ganga close to the Gazipur district of Uttar Pradesh. At today this river has grown contaminated as a result of expanded urbanisation, the discharge of domestic sewage as well as municipal rubbish, and substantial anthropogenic activity. An attempt was made to evaluate the water quality in this study.

The Gomati River was sampled at three locations: Golaghat, Dhobighat, and Shmashan Ghat. At each sampling location, surface water was gathered in the middle of the river, and clean plastic bottles were used to preserve it. Water temperature, pH, and dissolved oxygen were tested right away due to their erratic nature.

The acquired samples were sent right away to the lab for physico-chemical investigation of the sample water. Following standard APHA procedures, the collected samples were tested for heavy metals such chromium, lead, nickel, copper, zinc, and cadmium as well as biological oxygen demand (BOD), chemical oxygen demand (COD), free CO2 and TDS, DO, BOD, COD, nitrate, sulphate, and chloride (2005).

Due to growing industrialization, population development, and sewage disposal, contaminants are now being released into rivers at a rate that is far higher than how quickly they are being removed. The current study aims to look into the Gomti River's water quality in the Sultanpur District (U.P.).

Results and Discussion:

As per normal procedures, the monthly samples of the river Gomati obtained from four sites were physicochemically characterized for parameters including temperature, pH, DO, FCO_2, TSS, TDS, BOD, COD, nitrate, sulphate, chloride, and heavy metals. Table 1 summarises the results of the several physico-chemical characteristics of the river Gomti during the summer, monsoon, and winter from July 2013 to June 2014. The current study's findings demonstrate that all stations' measured metrics showed significant variation.

Table 1: Seasonal Variation in Physico-chemical Parameters of river Gomati at Sultanput city

Parameters	Season	Golagha	Dhobighat	Shmashan Ghat	Average
Temp^{0}C	Summer	28.70	30.40	31.30	30.13
	Monsoon	24.4	25.5	26.8	25.56
	Winter	16.2	17.5	16.5	16.33
pH	Summer	7.42	7.07	7.11	7.20
	Monsoon	7.44	7.25	7.38	7.35
	Winter	7.17	7.09	7.16	7.14
DO	Summer	6.05	6.15	5.90	6.03
	Monsoon	7.00	6.60	5.70	6.43
	Winter	7.42	7.35	7.75	7.50
FCO_2	Summer	54.8	59.4	56.5	42.42
	Monsoon	40.4	41.7	40.3	40.80
	Winter	36.4	36.7	37.4	36.80
Alkalinity	Summer	200.5	190.3	176.4	189.06
	Monsoon	198.4	190.3	180.4	188.70
	Winter	150.6	145.2	114.2	138.36
Hardness	Summer	101.0	102.0	115.0	106.0
	Monsoon	95.5	98.5	105.5	99.83
	Winter	105.5	107.8	122.4	111.90
TDS	Summer	406.0	405.5	505.5	439.0
	Monsoon	605.0	618.5	655.0	626.16
	Winter	450.0	470.5	541.5	486.30
BOD	Summer	7.4	8.0	9.40	8.15
	Monsoon	5.4	5.8	8.50	6.61
	Winter	5.1	6.1	6.1	5.76
COD	Summer	20.0	22.0	25.0	22.33
	Monsoon	11.40	12.40	15.40	13.06
	Winter	17.5	18.5	21.0	19.0
Chloride	Summer	25.5	30.5	35.5	30.5
	Monsoon	13.0	16.0	28.0	19.0
	Winter	15.30	17.30	19.30	17.30
Nitrate	Summer	0.60	0.83	2.00	1.06
	Monsoon	0.45	0.65	2.51	1.22
	Winter	0.54	0.64	2.04	1.07
Sulphate	Summer	24.30	24.50	27.70	25.50
	Monsoon	12.40	17.00	22.55	17.31
	Winter	16.50	20.50	23.00	20.00

Notes: All values are in mg/l except water temp and pH.

With the lowest temperatures in the winter and the highest temperatures in the summer, the water temperature varied with the seasons. The results of Singh and Gupta (2004) [18] in the Gomati River support these conclusions. Water temperature has an impact on both biotic and abiotic elements of the aquatic ecosystem, either directly or indirectly. Additionally, it represents the dynamics of the living thing, such as physiological and metabolic activity in aquatic habitats (Singh, 2014) [17]. The study's average temperature ranged from 16.35 to 30.130 degrees Celsius, with the summer months seeing the greatest average temperatures and the winter months experiencing the lowest average temperatures. Many workers saw such trends when working on diverse bodies of water (Sen *et al*., 2011; Singh, 2014) [15, 17]. The temperatures were found to be appropriate for the fish fauna's survival and growth, as fish need a moderate temperature for development and reproduction

(Ansari and Prakash, 2000) [4]. Changes in the air's temperature have a direct impact on the water's temperature. Summertime water temperatures were frequently warmer than wintertime ones. The water's temperature range was ideal for the growth and development of fish (Jhingran, 1988) [8].

Water's pH is a crucial chemical property that affects whether it is suitable for a variety of purposes. Water pH is important for biotic communities since the vast majority of aquatic organisms are acclimated to an average pH. The average pH for the summer, monsoon, and winter was 7.20, 7.14, and 7.35, respectively. The lowest pH value was found as a result of heavy rainfall over the winter. This study's pH measurements ranged from 7.14 to 7.35, which denotes slightly alkaline conditions. The BurhiGandak river had an alkaline pH, which is good for fish survival (Prakash. 2001; Khanna *et al*., 2013) [10, 9]. Dissolved oxygen, which directly affects the survival and distribution of flora and fauna in an aquatic ecosystem, is one of the most crucial factors in defining the quality of water. The average DO concentration during the observation period was close to 7 mg/l. This number is favourable for the growth of healthy fish. According to Rajagopal *et al*. (2010) [12], dissolved oxygen levels were highest in the winter and lowest in the summer. This difference may be due to organic molecules' high breakdown rates and reduced solubility at high temperatures. The findings of Ansari and Prakash support this conclusion (1999). Since fish need at least 5 mg/l of dissolved oxygen for growth and development, river water is sufficient. Air partial pressure, water temperature, and other variables all have an impact on the amount of D.O. in water.

The most crucial element in plants' photosynthetic activity is carbon dioxide. In bodies of water, CO2 combines with water to create carbonic acid, which swiftly breaks down into carbonates and bicarbonates and alters the pH of the water (Prakash, 2001) [10]. It was unexpected to see how CO2 behaved differently during various seasons' at all four sampling locations. Average free CO2 concentrations in the current study varied from 36.80 to 42.42 mg/L depending on the time of year and location. The winter had the lowest levels of free CO2 (36.80 mg/l), while the summer saw the highest levels (42.42 mg/L). Singh found comparable outcomes (2014). Degradation and decomposition of organic materials as well as the addition of industrial waste may be to blame for the rise in CO2 levels over the summer (Joshi *et al*., 1995) [7],

Alkalinity, or the capacity of water to neutralise strong acids, is principally determined by the amount of carbonate, bicarbonate, and hydroxide in the water. These substances are produced when carbon dioxide is dissolved in water. In this study, average alkalinity levels varied across all three seasons, from 138.06 to 189.06 mg/L on average, with summer seeing the greatest levels and winter seeing the lowest. Some researchers have found a similar pattern of alkalinity variations in river water (Sahni and Yadav, 2012; Sen *et al*., 2011; Khanna *et al*., 2011) [13, 15, 9]. The breakdown of bottom sediments transforms insoluble carbonates into soluble bicarbonates (Tabrez et.al. 2010). River water's alkalinity range shows that photosynthetic activity has surpassed biota respiration activity (Ansari and Prakash, 2000) [4]. Alikunhi (1957) [2] suggested that highly productive water should have an alkalinity of at least 100 mg/l. It was suitable for fish farming since the alkalinity of the water in the Gomti stayed higher all year.

Total hardness levels varied by season, from 99.83 to 111.90 mg/L, with summer having the greatest value (121.90 mg/L) and monsoon having the lowest value (99.83 mg/L). This might be caused by the high concentrations of calcium, magnesium, sulphate, and nitrate (Singh, 2014) [17]. The increase in hardness can be attributed to high loading organic compounds, detergent, chloride, and other contaminants, as well as a decrease in water volume and an increase in the rate of evaporation at high temperatures. According to several classifications, water with a hardness of up to 75 mg/l is considered soft, 76-150 mg/l is considered fairly soft, 151-300 mg/l is considered hard, and more than 300 mg/l is considered very hard (Saravanakumar and Kumar, 2011) [14]. Based on classification, the chosen water samples from the Gomti River can be categorised as soft.

High levels of dissolved solids modify the density of water, affect the osmoregulation of freshwater species, decrease the solubility of gases (including oxygen), and decrease the usefulness of water for drinking, irrigation, and industry. Based on the TDS level of the water, it may be determined if it is appropriate for drinking and irrigation (below 3,000 mg/L), permissible for drinking (up to 1,000 mg/L), advantageous for irrigation (up to 2,000 mg/L), or not suitable for either (above 3,000 mg/L) (Lokhande, *et al*. 2011) [20]. The current study found that the average total dissolved salts (TDS) varied from 439.0 mg/l (In summer) to 626.16 mg/l (in monsoon), above the maximum advised for drinking water.

The average biological oxygen demand (BOD) of the water in the Gomati River ranged from 5.76 mg/L to 8.15 mg/L. In all of the samples, the permissible level was exceeded (EPA, 2001). The Department of Energy states that BOD levels in drinking water are restricted to 0.2 mg/L, recreation to 3 mg/L, fish to 6 mg/L, and irrigation to 10 mg/L. (1997). The Gomati river's BOD levels, with the exception of site 1, were therefore inappropriate for fish production. Water from the Gomati River has a COD that varied from 5.86 mg/l to 8.36 mg/l. additionally, it fell below the limit for fish growth and reproduction in terms of size and quantity. Excessive BOD and COD are caused by the presence of chemicals, both organic and inorganic, brought on by the influx of home and industrial waste containing significant levels of organic contaminants.

The average chloride concentration in this study ranged from 17.30 to 30.05 mg/L, with the summer season having the greatest value (30.05 mg/L) and the winter season having the lowest value (17.30 mg/L). Throughout the winter, other researchers noticed decreased chloride levels in freshwater bodies (Shiddamallaya and Pratima, 2008) [16]. Higher chloride concentrations in the summer may be caused by increasing warmth, low water levels, and sewage mixing, according to Venkatesharaju *et al*. (2010) [22]. The increasing chloride concentration at site 3 is believed to be a result of increased sewage discharge contamination.

In this study, the average nitrate level varied from 1.06 mg/l in the winter to 1.22 mg/l in the summer (In Summer). According to Aboyeji (2013) [1], nitrate is generally safe for fish health unless the concentration in the water surpasses 90 mg/L. In the BurhiGandak, sulphate concentrations ranged from 17.41 mg/l in the winter to 25.60 mg/l in the summer (in summer). The sulphate level in the Gomati River was determined to be too high for fish growth when compared to the EPA limit of 2.0 mg/L.

Conclusion

The purpose of this study was to evaluate the physicochemical parameters of surface water collected from four different

sampling sites along the Gomati River at Sultanpur Town. This experiment revealed that various physicochemical parameters, like as temperature, pH, DO, FCO2, alkalinity, and hardness, were within permissible limits in India, whereas TDS, BOD, and COD concentrations were significantly higher than national and international requirements. As a result of the data collected on physicochemical characteristics, it was discovered that the water quality of the River Gomati at Sultanpur city was good enough to sustain life and that the water could be used for a variety of purposes.

References

1. Aboyeji OO. Freshwater Pollution in Some Nigerian Local Communities, Causes, Consequences and Probable Solutions. Academic Journal of Interdisciplinary Studies. 2013;2(13):111.
2. Alikunhi KH. Fish culture in India, Fm, Bull. Indian Coun. Agri. Res. 1957;20:144.
3. Arimieari LW, Sangodoyin AY, Ereoforiokuma NS. Assessment of surface water quality in some selected locations in Port Harcourt, Nigeria. International Journal of Engineering and Technology. 2014;3:1146-1151.
4. Ansari KK, Prakash S. Limnological studies on Tulsidas Tal of Tarai Region of Balrampur in relation to fisheries. Pollution Research. 2000;19(4):651-655.
5. Ansari KK, Prakash S. Limnology of Rani Tal, Balrampur (U.P.) in relation to Fisheries. Flora and Fauna. 1999;5(2):89-90.
6. APHA. Standard methods for examination of water and waste water, 21 Edition, American st. Public Health Association, Washington, DC., USA. 2005.
7. Joshi M, Shishodia SK, Kumar SN, Saikia DK. Ecosystem studies in upper region of Ganga river, Enviromental monitoring and assessment. 1995;35:181-206.
8. Jhingran VG. Fish and fisheries of India. Hindustan Publishing Corporation, India. 1988, 666.
9. Khanna DR, Bhutiani R, Gagan Matla, Singh Vikas, Bhadauriya Gaurav. Physico-chemical property of river Ganga at foot hills of Garhwal Himalayas. 2011.
10. Prakash S. Utilization of Brick-Kiln Land in Aquaculture. GEOBIOS. 2001;28(4):193-196.
11. Prakash S, Ansari KK, Sinha M. Seasonal dynamics of Zooplankton in a fresh water pond developed from the wasteland of Brick-kiln. Poll. Res. 2002;21(1):82-83.
12. Rajagopal T, Thangamani A, Sevarkodiyone SP, Sekar M, Archunan G. Zooplankton diversity and physic-chemical conditions in three perennial ponds of Virudhunagar district. Tamil Nadu. J of Environmental Biology. 2010;31:265-272.
13. Sahni K, Yadav S. Seasonal variation in physico-chemical parameters of Bharawas Pond, Rewari, Haryana. Asian J Exp. Sci. 2012;26 (1):61-64.
14. Saravanakumar K, Kumar RR. Analysis of water quality parameters of groundwater near Ambattur Industrial Area, TamilNadu, India, Indian Journal of Science and Technology. 2011;4(5):560-562.
15. Sen Sujata, Paul Mrinal Kanti, Borah Madhab. Study of some physic-chemical parameters of pond and river water with refrence to correlation Study. International journal of Chem Tech Research. 2011;3(4):1802-1807.
16. Shiddamallayya N, Pratima M. Impact of domestic sewage on fresh water body. Journal of Environmental Biology. 2008;29(3):303-308.
17. Singh P. Studies on Seasonal variations in physico-chemical parameters of the river Gomti (U.P.) India. International Journal of Advanced Research. 2014;2(2):82-86.
18. Singh M, Gupta KC. Physico-chemical studies of water river Yamuna of Mathura. Eco. Env and Conv. 2004;10(2):193-196.
19. Tabrej A, Paul N, Shukla K, Sharma AK. Water quality assessment of river Gomti at Lucknow U.P. India. Pollution due to industrial and domestic wastes. Aquacult. 2010;11(1):39-46.
20. Lokhande RS, Singare PU, Pimple DS. Pollution in Water of Kasardi River Flowing along Taloja Industrial Area of Mumbai, India. World Environment. 2011;1(1):6-13.
21. Usharani K, Umarani K, Ayyasamy PM, Shanthi K, Lakshmanaperumalsamy P. Physico-chemical and bacteriological characteristics of noyyal river and ground water quality of Perur, India. Journal of Applied Sciences and Environmental Managements. 2010;14:29-35.
22. Venkatesharaju K, Somashekar RK, Prakash KL. Study of seasonal and special variation in surface water quality of Cauvery river stretch in Karnataka. Journal of ecology and the natural environment. 2010;2(1):001-009.