DOI: 10.5281/zenodo.14232407

CHAPTER 21

Hydro Biological Characteristics of Godavari River at Luxettipet, Mancherial Dist. Telangana State

Pathi Chandra Shekar

Department of Zoology, Government Degree College, Luxettipet, Mancherial District 504215 Telangana State, India

Corresponding author Email: chandrashekarpathi1978@gmail.com

Received: 07 September 2024; Received in revised form: 11 September 2024; Accepted: 14 September 2024; Available online: 28 November 2024

Abstract

The variety of life on Earth is known as biodiversity, and it comprises all species and populations of organisms. Hydrobiology and the presence of organochlorine pesticides (OCPs) in the Godavari River Luxettipet, Mancherial dist., Telangana state, are the subjects of this study. The five main OCPs that were monitored in the samples were DDT, Aldrin Group, and hexa-chlorocyclohexanes (HCHs). The hydro chemical characterization assesses the water quality for use in irrigation.The results examine Total Dissolve Solids (TDS) in the water range from 115 to 676 mg/L, and the pH of the water the pH of the water with on average. The levels of anions and cations were as follows: HCO_3>SO_4^{2-}>Cl^->CO_3^{2-} anions and Ca^{2+}>Na^+>Mg^{2+}>K^+ cations in mg/L. The highest hydrochemicals were found as bicarbonates of the Ca^-HCO_3 kind. In contrast to above and downstream of the mainline, the characterisation was distinct.

Interdisciplinary Research in Life Sciences: A Path Towards Sustainability (Vol. 2) - Jayvardhan V. Balkhande & Jalander Vaghmare (Eds.)

ISBN: 978-93-95369-81-7 | © 2024 Advent Publishing. All rights reserved.

https://doi.org/10.5281/zenodo.14232407

Analysis reveals variances at various locations and times of year, which have an impact on aquatic flora and fauna's habitat, growth, reproduction, and migration. At. Godavari river, in Luxettipet i, Telangana state, the water quality is ideal for irrigation and swimming during a specific season. Threats to the river, Luxettipet, fauna include changes in pollution, invasive species, habitat loss, degradation, hydrological fluctuations, chemo-geo diversity, and nutrient enrichment, degradation, droughts, and more.

Keywords: Hydrobiology, Chemo-geo-diversity, In Godavari and Organochlorine pesticides

Introduction

The Himalaya is the source of several significant rivers, including the Yamuna, Ram Ganga, and Ganga. Because surface water resources store, transmit, and alter inorganic and natural carbon components across the hydrologic continuum - the region connecting land and sea - they are important to the global carbon cycle. Current studies have focused on the movement of particulate natural carbon and decomposed organic carbon across rivers, as well as the exchange of CO_2 between surface water and the atmosphere (Raymond *et al.*, 2013; Wehrli *et al.*, 2013; Ward *et al.*, 2017). The analysis is restricted to India's riverine stream frameworks, leaving several vulnerable places in global river combinations for the transportation and disposal of carbon. Despite the fact that Asian waterways have been evaluated as contributing up. A watershed's hydrochemical structure reflects the characteristics of the environment it flows through. An analysis of the hydrochemical water can determine the geochemical source of the waterway solute and associated information, such as the watershed's atmosphere and longevity (An *et al.*, 2015). Surface water is contaminated by a variety of factors, including anthropogenic sources, barometric precipitation, and the effects of earthly tremors (Moon *et. al.*, 2007). As human activity levels rise and the environment changes, streams that originate in the Himalaya region are experiencing changes in their hydrochemical properties (Zhang *et. al.*, 2015 and Zhang *et al.*, 2019). Regardless, the Ganga waterways have been the primary subject of several previous hydrochemical concentrates on the headwaters of streams beginning from the Gadgetry (Wu *et al.*, 2008; Jiang *et al.*, 2015).

The variety of life on Earth is known as biodiversity; it consists of all types of organisms, species, and populations as well as the genetic variation among them and the intricate webs of communities and ecosystems. The variety of species and ecosystems that make up freshwater and tidal zones worldwide, as well as their interactions, are together referred to as aquatic biodiversity. In tropical regions, aquatic biodiversity is highest.

Fig. 1. Godavari River at Luxettipet

Chemical and Physical Parameters

In the laboratory, the titration method was used to quantify alkalinity, chloride, and hardness. While TOC was examined using a TOC analyzer (Shimadzu), nitrate and ammonia were detected using selective ion electrodes (Thermo and HACH, respectively). On-site portable meters were used to test the EC, pH, DO, and total dissolved solids (TDS). pH, total organic carbon (TOC), ammonia asperAPHA (1998), electrical conductivity (EC), alkalinity, chloride hardness, dissolved oxygen (DO), and nitrate. Removal Prior to GC analysis, all samples were extracted without pH adjustment and filtered through a 0.45µm glass fiber filter to eliminate suspended impurities. Pesticide residues were extracted using a liquid extraction (LLE) method using n-hexane as the solvent (APHA-1998). The sample was moved to a separating funnel (1000 mL cap.) after the sample beaker was shaken and filtered. It was combined with 40 ml of n-hexane and 20 g of sodium chloride. The sample was correctly chopped for 60 minutes, and a separating funnel was used to separate the hexane layer.

Analysis of Organo Chlorine Pesticide

OCPs Thermo Trace GCUl trag as chromatograph, which is outfitted with an auto sampler and a GC-ECD, a 63-Ni micro-electron capture detector was used to investigate the contamination of OCPs. The operating conditions and column parameters are Column DB-5 has a fused silica capillary with an ID of 30 m × 0.25 mm and a thickness of 0.25 µm. The carrier gas is helium, and the makeup is 30 ml/min N. The oven programming ranges from 90-150°C to 220°C to 5°C. Detector temperature: 280°C, Injector temperature: 250°C, Injection volume: 2.0µl.

Physical and Chemical Parameter Status

The water quality in the hilly Ganga region is excellent, with low EC, TDS, and TOC levels, high DO levels (average 8.17−0.4), and no discernible pollution. The Ganga enters Uttar Pradesh by the Jinor station, which is followed by numerous tiny rivers and sub-basins that combine into the river. According to CPCB-2009, the STPs cut half of the trace pollutants found in the effluent and between 61 and 93% of organic loadings. In this stretch, domestic sewage is the main source of pollution. The water quality in the stretch is impacted by household, industrial, organic, and inorganic runoff from Rishikesh (Uttarakhand)

and agricultural sources. The Dissolve Oxygen (DO) levels across all samples ranged from 4.9 to 7.9 mg/L (DOavg (mg/L) = 5.6√1.2). Despite some of the most highly contaminated areas in this zone, the water quality data collected during this sampling campaign indicated that the river water quality was good due to the high monsoonal flow (Table 1).

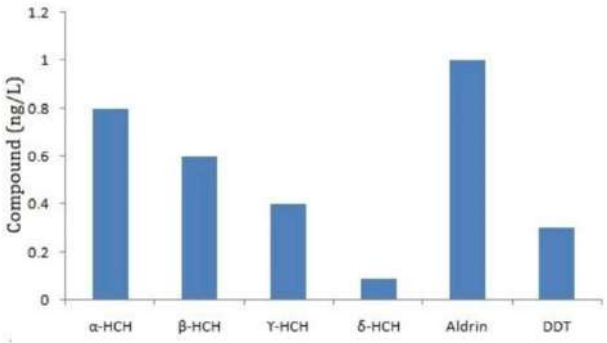

Fig. 2. Comparison of reported organochloride pesticides (OCPs) levels in the Godavari River, Luxettipet

Pesticides with organochlorine Throughout the Ganga basin, the agricultural sector uses a variety of organochlorine pesticides (Rehana *et al.*, 1995; Nayak *et al.*, 1995; Malik *et al.*, 2009). In addition to the runoff from agricultural fields, India's common agricultural practices in the dry riverbeds (Hans *et al.*, 1999) also include the addition of pesticides to the river during the monsoon season. The OCP levels in BijnorUP, Ganga garage are displayed in Figure 2. This stretch concentration ranges from 0.2 to 1.00 ng/L for the targeted OCPs. The percentage of the middle of the Ganga's mainstream was the greatest in the whole catchment every year (2017–2019), with major features varying. The pH of all analysis sample had an average of 7.2 and a slightly alkaline range of 7.89 to 8.42. In 2017, 2018, and 2019, the observed water temperature was between 9.42 and 29.07 °C, 9.42 and 28.82 °C, and 8.87 and 30 °C. Ganga water total soluble solids (TDS) range from 85 mg/L to 453 mg/L, with an average of 250 mg/L. In 2017, 2018, and 2019, TDS of the Ganga water from the Ganga River's main stream was the highest in the whole catchment. The range of electrical conductivity (EC) was 125 µS/cm to 425 µS/cm, with an average of 282 µS/cm. This phenomenon might have been produced by increasing order. Additionally, in 2017, 2018, and 2019, the Ganga's main stream had the greatest EC in the whole basin. Table 1 displays the pH, TDS, and electrical conductivity of the Ganga River's main stream.

The Biodiversity of Fresh Water

A portion of the aquatic ecosystems on Earth are known as freshwater ecosystems. Lakes, ponds, rivers, streams, bogs, springs, and wetlands are among them. Limnology is a branch of hydrobiology that studies freshwater organisms. Numerous elements, like as temperature, light penetration, nutrients, and vegetation, can be used to categorize freshwater habitats (Wetzel *et al.*, 2001). Because freshwater environments have many distinct thermal characteristics, the temperature in these areas does not vary considerably. Water turbidity Depends on the types and quantity of suspended materials, such as clay particles, live organisms, and soil. Turbidity is a significant factor in the distribution of organisms because

it affects the penetration of light. Species diversity in large rivers is higher than in small streams. Many link this pattern to increased habitat diversity as well as the larger area and volume of larger systems. But in other systems, the relationship between species richness and system size is ill-fitting. The following is a general classification of organisms found in freshwater habitats: autotrophs (producers), phagotrophs (macroconsumers), saprophyton (decomposer or microconsumer), benthos (bottom), periphyton (attached to other plants), planktons (floating), nekton (swimming), andneuston (resting or swimming on surface). These classifications are based on major niches, life habit, and subhabitat. Freshwater habitats can be divided into lotice systems, or flowing water, and lentice systems, or stillwater. lentic communities Lentic communities are divided into three distinct zones: profundal, limnetic, and littoral. Producers include floating green plants, phytoplankton, algae, rooted hydrophytes (Typha, Scirpus, Sagittaria, Eleocharis, etc.), primarily seed plants, and rooted and benthic plants (Nymphaea, Nelumbo). These algae, known as diatoms or green algae, come in colonial and unicellular forms, including desmid and filamentous (attached or floating), species of several colonial forms, including Hydrodictyl on and Volvox, and species of Spirogyra, Oedogonium, Cladophora, Chara, etc.

Table 2. Summary statistics of hydrochemical compositions from the Godavari River, Luxettipet

Parameters	Mean	Standard Deviation	Min	Max
Temperature (°C)	24°C	6°C	8.4°C	31°C
pH	7.61	2.34	6.24	9.41
EC (μS/cm)	374	172	345	453
TDS (mg/L)	362	221	263	463
K^+ (mg/L)	2.61	1.09	2.34	5.38
Na^+ (mg/L)	44.46	15.89	39.13	54.32
Ca^{++} (mg/L)	72.54	14.53	56.49	87.03
Mg^{++} (mg/L)	27.85	9.42	24.31	32.05
Cl^- (mg/L)	22.45	4.64	16.37	21.65
SO_4^{--} (mg/L)	123.62	31.88	7.05	154.69
HCO_3^- (mg/L)	217.13	61.68	143.13	287.08
TOC (mg/L)	5.4	1.2	3.2	5.9
Nitrate (mg/L)	2.1	0.8	1.2	3.7
Ammonia (mg/L)	5.3	1.7	2.6	8.7
Hardness (mg/L)	152.7	156.7	136	172.1
Alkalinity (mg/L)	161.3	213.4	156	192.4
DO (mg/L)	4.6	2.8	4.7	7.9

The consumer is animal in the in littoral zone, where vertical rather than horizontal zoning is more conspicuous. Although they are a relatively safe species, zooplankton is abundant. In general, copepods, cladocerans, and rotifers are found. Other vertebrate taxa in trophic systems are also common forms. Among them are amphibians, such as frogs and salamanders. Reptiles, including alligators, turtles, and snakes, as well as numerous kinds of water fowl (Moss *et al.*, 1998). Since the majority of these species live in terrestrial environments, abiotic elements in lakes and ponds do not directly influence them. Numerous fish species are significant both as prey and consumers of the larger animals previously described. Fish can exploit a wide variety of prey, spanning several zonation areas, thanks to their size, movement, and sensory capacities. Fish feeding patterns can be divided into guilds, just like those of invertebrates. Herbivores in the pelagic zone harvest phytoplankton from the water column or graze on macrophytes and periphyton. Fish that consume plankton in the water column are known as zooplanktivores; fish that consume other fish are known as piscivores; and fish that feed on insects at the water's surface, on benthos, or in this sediment are known as insectivores, are examples of carnivores. Known as detritivores, these fish devour detritus and obtain energy by breaking down its organic matter. A vast range of prey, including plant, animal, and detrital debris, is consumed by omnivores. Lastly, a host species - typically a different fish or big vertebrate - provides sustenance to the parasitic guild members (Le *et al.*, 2006). Fish taxa are adaptable, that they feeding functions, adjusting their diets based on the availability of prey and the surrounding surroundings. As they evolve, many species also experience changes in their food. Consequently, it is probable that a single fish will occupy several feeding groups during its lifetime (Lytle *et al.*, 1999).

Conclusion

Human societies depend on healthy freshwater ecosystems for essential ecosystem services like clean drinking water, agriculture, fisheries, wetlands, flora, and fauna. This paper describes the hydrobiological features of the Ganga River barrage in Bijnor, Uttar Pradesh. Hexachlorocyclohexanes (HCHs), OCPs, DDTs, and the Aldrin group were the five standards that were checked in water samples. The results examine the pH of water and Total Dissolve Solids (TDS) levels, which range from 115 to 676 mg/L on average. Anion concentration (mg/L) was HCO^{-}> SO^{2-}> Cl^{-}> CO^{2-}, whereas cations concentrations were Ca^{2+} > Na^{+} > Mg^{2+} > K^{+}. $Ca^{-}HCO_3$ bicarbonates were the most abundant hydrochemicals. The hydrochemical characterisation assesses the water's suitability for irrigation. Water quality analysis reveals changes at various places and seasons that impact aquatic flora and fauna's growth, reproduction, and habitat. At Godavari River, Luxettipet, Telangana. the water quality is sufficient for irrigation and bathing during a specific season. There were differences in the hydrochemical characterisation above and downstream of the mainstream. Broad categories such as varying high flood and draught, invasive species domination, hydrological changes, chemo geodiversity, habitat loss, degradation, and pollution and pollution pose risks to the fauna of the Godavari River, Luxettipet. Farmers should use fewer insecticides, pesticides, and herbicides in their agricultural practices with the goal of raising the Godavari water's quality.

References

1. Rao, R. J. (2001). Studies on biological restoration of Ganga River in Uttar Pradesh: an indicator species approach. Hydrobiologia, 458: 159-168
2. Raymond, P. A., Hartmann, J., Lauerwald, R., Sobek, S., McDonald, C., Hoover, M., Butman, D., Striegl, R., Mayorga, E., Humborg, C., Kortelainen, P., Dürr, H., Meybeck, M., Ciais, P. and Guth, P. (2013). Global carbon dioxide emissions from inland waters. Nature, 503 : 355-359.
3. Rehana, Z., Malik, A. and Ahmad, M. (1995). Mutagenic activity of the Ganges water with special reference to the pesticide pollution in the river between Kachla to Kannauj (U.P.) India. Mutation Research, 343 : 137-144.
4. Scarborough, C. L., Ferrari, J. and Godfray, H. C. J. (2005). Aphid protected from pathogen by endo symbiont. Science, 310 (5755): 1781-1781.
5. Schlunz, B. and Schneider, R. R. (2000). Transport to terrestrial organic carbon to the oceans by rivers: re-estimating flux-and burial rates. International Journal of Earth Sciences, 88: 599-606.
6. Sharma, M. K. and Rajput D. B. (1986). Ichthyo fauna of Bijnor district Uttar Pradesh. Journal of the Bombay Natural History Society, 83: 562-569
7. Wang, F., Zhao, Y., Chen, X. and Zhao, H. (2019). Hydrochemistry and Its Controlling Factors of Rivers in the Source Region of the Nujiang River on the Tibetan Plateau, Water, 11: 2-18
8. Ward, N. D., Bianchi, T. S., Medeiros, P. M., Seidel, M., Richey, J. E., Keil, R. G. and Sawakuchi, H. O. (2017). Where Carbon Goes When Water Flows: Carbon Cycling across the Aquatic Continuum. Frontiers in Marine Science, 4: 7.
9. Wehrli, B. (2013). Conduits of the carbon cycle, Nature, 503: 346-347
10. Wetzel, R. G. (2001). Limnology: lake and river ecosystems (3rd ed.). San Diego: Academic Press.
11. Wu, L., Huh, Y., Qin, J., Du, G. and VanDerLee, S. (2005). Chemical weathering in the Upper Huang He (Yellow River) draining the eastern Qinghai Tibet Plateau. Geochimica et Cosmochimica Acta, 69: 5279-5294.