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Impact of COVID-19 Pandemic on Rivers: A Review

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Abstract: *The COVID-19 pandemic had a significant impact on several environmental aspects as well as human life. Due to the severity of the pandemic, the whole planet went into absolute lockdown, limiting human mobility in order to stop the corona virus from spreading. As all forms of industrial, commercial, and social activity ceased, environmental conditions such as air quality and water quality, which had been gravely harmed by pollution, greatly improved. Nature was able to cure itself as a result of this. The indicators of environmental improvement might be seen in different elements of nature. The influence of COVID-19 on rivers is highlighted in this review. Rivers are vital to the survival of life on Earth, contributing to agriculture and biodiversity. Despite the world's socio-cultural and economic progress being restricted, the environment's health, particularly water, has greatly improved. During the lockdown, companies near the river's catchment region were shut down, resulting in a dramatic improvement in water quality. Because of the lockdown and travel limitations, anthropogenic activities on the river ecology were kept to a minimum, preventing contamination. The purpose of this review is to discuss the influence of the COVID-19 Pandemic on rivers, and the conclusion is that "Although corona virus vaccine is accessible for people, corona virus is itself Earth's vaccine."*

Keywords: COVID-19, Pandemic, Lockdown, Corona virus, Rivers, etc.

I. INTRODUCTION

The first case of COVID-19 was recorded in India on January 30th, and due to an increase in the number of positive cases, a state-wide 14-hour voluntary curfew was imposed on March 22nd. The curfew was initially extended for another 21 days, from March 25th to April 14th. This lockdown forced people to stay at home by closing schools, industries, companies, marketplaces, and religious and social events. It halted all types of travel, except for emergencies, and closed national and international borders. The lockdown was prolonged in stages until June 8, 2020, with a total of 75 days of lockdown completed under very stringent constraints, and the country came to a halt during this timeframe. [1] The World Health Organization (WHO) recommended keeping social distance in this hazardous situation, and people were required to wear face masks. The majority of countries declared a 'lockdown' to prevent public transmission and break the infection cycle. Almost all sectors have been momentarily congested as a result of the lockout. The Indian blackout lowered all human activity, resulting in lower emissions and a reduction in the creation of industrial waste and other pollutants in metropolitan areas. Water is one of the most vital life-sustaining components of the environment, providing energy to all biotic and abiotic elements of the ecosphere while also maintaining environmental balance.

In normal times, different human activities such as industrialization, urbanization, agricultural practice, and overexploitation have severely degraded this natural resource. However, because of the lack of mixing of industrial effluent, solid waste, heavy metals, and other pollutants in the aquatic environment during the lockdown time, the contamination level in the aquatic ecosystem has been significantly reduced. [2] In developing nations like India and Bangladesh, where residential and industrial wastes are discharged into rivers without treatment, water pollution is a typical occurrence. During this closure, the primary industrial sources of pollutants shrank or ceased entirely, helping to lower pollution levels [3-4]. Most rivers and streams have been contaminated to a critical degree for the sake of economic progress, making treatment impossible.

Every day, about 40 million liters of wastewater are projected to reach rivers and other aquatic bodies, with just 37% be ing fully cleaned. The review. highlights the influence of COVID-19 on rivers.

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II. METHODOLOGY

This research was carried out by studying the literature, case studies, and material from various government and non-government organizations' papers and official websites. The facts and information pertinent to the consequences of the COVID-19 pandemic on waterways are compiled and presented in this paper.

Effect of Covid Pandemic on some rivers

Anthropogenic activities are known to be one of the primary drivers of pollution within various spheres of the environment. Researchers have emphasized that the lockdown period has drastically reduced industrial waste generation, industrial pollution, and the addition of heavy metals and plastic to the hydrosphere through different sources[5-7]. Thus, at the time when COVID-19 crippled Italy, the Grand Canal in Italy became much clear and some aquatic species reappeared [4]. These findings are similar to the case of the rivers in India, which were found to be cleaner during the lockdown period in India [8]. The following are some findings on rivers Godavari Krishna Tapi and Narmada of Maharashtra.

1. **River Godavari**

   The river Godavari is the second largest river in the Indian Union. The Godavari rises in the Western Ghats at Triambak near Nasik, about 113 km northeast of Bombay and only 80 km from the Arabian Sea. After descending the Western Ghats, it takes a south-easterly course across the southern part of the Indian peninsula and flows through 1,230 km, and falls into the Bay of Bengal about 80 km east of Rajahmundry. The total catchment area drained by the river is 312,812 km^2 or nearly one-tenth of India. The catchment in Maharashtra is about 152,199 km2. The average annual flow (50% dependable flow) of the Godavari basin has been estimated as 110.5 km^3, whereas the utilizable flow (75% dependable flow) is about 76.3 km^3. The present utilization is only about 39 km^3, which is hardly 50% (Carg 1999). The Godavari River passes through the industrially developed Maharashtran city of Nashik.

   In addition, 125 large and 350 medium scale units and about 2,500 small scale units are also presently working in the industrial estate and are located in the upper part of the city and on the banks of the river. This industrial development has resulted in the massive growth of some other industries like laundry, hotels, restaurants, pathological laboratories, nursing homes, etc. The river water is presently being used for domestic purposes such as drinking, bathing, cleaning, cooling, and others, and untreated sewage and industrial effluents together with solid wastes are finding their way directly into the river [9]. Therefore, Godavari River is highly polluted but the lock-down period was a detoxification period which ultimately resulted in an improvement in water quality. Researchers analyzed the water quality by employing various parameters like pH, Dissolved Oxygen (DO), Biological oxygen demand (BOD), and faecal coliform (FC).

   The results obtained were comparatively studied before and after lockdown. Thus, pre-lockdown pH ranged from 7.1 to 8.1, while DO range from 3.1 to 6.9 (mg/L), BOD was between 2.2 to 8.8 (mg/L) and FC was between 2 to 70 MPN/100mL. The extreme change was observed during the lockdown in DO which ranged between 5 to 6.8 (mg/L), while BOD was in the range of 2.4 to 6.2 (mg/L) and FC was reduced within the range of 2 to 47 MPN/100mL. No major change was observed in pH. The improvement in the water quality was due to the closure of industrial units, various domestic activities, etc

2. **River Krishna**

   Krishna River is the second largest river in the southern part of India in terms of water inflows and basin area, after the Godavari. Fig. 1 represents the location map of the study area. Lakshman Kumar et.al. The length of the Krishna River is about 1,400 kilometers (870 miles) and has a catchment area of 76252 (sq.km.) in both Andhra Pradesh and Telangana. The Krishna River is one of the prime sources of irrigation for Maharashtra, Karnataka, Telangana, and Andhra Pradesh.

   The main tributaries of the Krishna River are the Ghataprabha River, Malaprabha River, Bhima River, Tungabhadra River, and Musi River. The major dams/ reservoirs/ weirs across the main river course are Sunkeshula, Srisailam, Nagarjuna Sagar, and Prakasam barrage. It causes heavy soil erosion during the monsoon

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periods. During its 810 miles large flow it provides valuable freshwater, that is found as a major source of drinking, irrigation, and industrial activities for the nearby situated villages and cities. However, in return rivers get a large amount of domestic and agricultural sewage along with industrial effluents. So, now the river is facing the serious problem of water pollution which further causes severe health impairments to humans along with the aquatic flora and fauna of the river. [10] Based on the analytical results of the samples collected from river Godavari, the observations made before lockdown were, pH 7.0 to 8.3, DO 6 to 6.7 mg/L, BOD 1.8 to 6.3mg/L and FC 7- 200 MPN/100mL, and during the lockdown, the river was clearer and showed a change in the parameters as pH 7.2 to 8.2, DO was between 6.6 to 6.7 mg/L, BOD was between 1.5 to 1.6 mg/L and FC was 17 MPN/L. This indicates the improvement of the quality of water during the lockdown.

3. **River Tapi**

Tapi is one of Peninsular India's major rivers, running from east to west for 724 kilometres. The Tapi river begins at a height of approximately 752 metres near Multai in Madhya Pradesh's Betul district and runs for about 724 kilometres before emptying into the Arabian Sea through the Gulf of Cambay. The Tapi is the second-largest westward draining inter-state river basin. It covers a large area in the State of Maharashtra. The Tapi River drains an area of 65145 sq km out of which nearly 80 percent lies in Maharashtra. The Tapi Basin is situated in the northern part of the Deccan Plateau and extends over an area of 65145 sqkm which is nearly 2% of the total geographical area of the country. Nearly 80% of the basin lies in the State of Maharashtra.

The dumping of untreated water and garbage into Tapi by more than 150 industrial units under the control of the Surat Urban Development Authority (SUDA) is a major cause of contamination of river water. Around 87 settlements in the SUDA boundaries, both upstream and downstream of the river, discharge sewage into it. The main source of pollution in the Tapi river is the discharge of trash and effluents. The parameters before and after the lockdown on the Tapi river were compared during the pollution assessment to see how the lockout affected the river's water quality.

Tapi During Prelockdown, the pH was 7.8, the DO was 5.8 to 6 mg/L, the BOD was 3.2 to 4.0, and the FC was 14-17 MPN/100ml. Due to the closure of major enterprises and institutes, as well as the cessation of human activity and absolute lockdown, most industries and institutes have been closed. During lockdown the pH was between 7.7 to 7.8 which did not show any significant change, the DO measured was in the range of 6.2 to 6.7 mg/L, BOD was between 2.8 to 4 mg/L and FC was between 11 to 13MPN/100ml.

4. **River Narmada**

The Narmada is Peninsular India's greatest west-flowing river. It rises at an elevation of roughly 1057 metres from the Maikala range near Amarkantak in Madhya Pradesh's Anuppur district. The river runs in Madhya Pradesh for the first 1079 kilometres before forming the common border between Madhya Pradesh and Maharashtra for 35 kilometres and Maharashtra and Gujarat for 39 kilometres. It is 159 kilometres long in Gujarat State. Through the Gulf of Khambhat, the Narmada empties into the Arabian Sea.The major part of the basin is covered by agriculture accounting for 56.90%. Water bodies cover 2.95% of the total basin area. It flows 1,312 km west through the states of Madhya Pradesh, Maharashtra, and Gujarat, of which 1,077 km is within Madhya Pradesh [11] The Narmada is bordered by lush woodland in its higher reaches, around Amarkantak.

It goes from Amarkantak's hills to Dindori, Mandala, Jabalpur, Narsinghpur, and Hoshangabad, meeting the water needs of the region's enormous population (Census of India, 2011). The Narmada, like other important rivers in India, such as the Ganges and the Yamuna, is being harmed by pollution sources between Amarkantak and Hoshangabad. Religious activities, public gatherings, swimming, and home effluent discharges are all possible sources of threats (see Table 2).

Farming practices in the Narmada watershed are intense, around 100 kilometres from its source, and may contribute to pollution through surface runoff. Small drains on the riverbanks also discharge sewage into the river from industrial activity, restaurants, and resorts. Along the river, major towns/cities like as Dindori, Mandala, and Narsinghpur lack sewage treatment systems, exposing the river to sewage contamination.

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[12] The assessment of the water of Narmada before lockdown and during lockdown revealed improvement in the water quality. The samples analyzed showed pH 8 before lockdown and pH 7.6 during the lockdown, the DO value prelockdown was 5.38mg/L and during lockdown was 7.6 mg/L, and the BOD values were 1.09 mg/L before lockdown and 1mg/L during the lockdown. This data indicates that the lockdown period was the recovery period.

Table 1: Summarise changes in river pre- lockdown and during lockdown (Source: Assessment of Impact of Lockdownon Water Quality of Major Rivers. CENTRAL POLLUTION CONTROL BOARD, Ministry of Environment, Forest & Climate Change, Parivesh Bhawan, East Arjun Nagar, DELHI-110032, September 23, 2020)

Rivers	Durations	pH	DO (mg/L)	BOD (mg/L)	FC (MPN/100mL)
Godavari River	Pre- lockdown	7.1 - 8.1	3.1 - 6.9	2.2 - 8.8	2 - 70
	During lockdown	7.0 - 8.1	5.0 - 6.8	2.4 - 6.2	2 – 47
Krishna River	Pre- lockdown	7.0 - 8.3	6.0-6.7	1.8 - 6.3	7 - 200
	During lockdown	7.2 - 8.2	6.6-6.7	1.5 -1.6	17
Tapi River	Pre- lockdown	7.8 - 7.8	5.8 – 6	3.2 - 4.0	14 - 17
	During lockdown	7.7 - 7.8	6.2-6.7	2.8 - 4.0	11- 13
Narmada River	Pre- lockdown	8.0	5.38	1.09	-
	During lockdown	7.6	7.6	1	-

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III. Conclusion

After analysing the different reports stated earlier, it can be concluded that while COVID-19 has surely provided humans with a terrifying experience, it has also shown to be a boon for the natural world, giving it with a "healing time." Although corona virus vaccine is accessible for people, corona virus is itself Earth's vaccine" this statement is bit proved by above findings. "Recovery in the water" has been documented in just 1–2 months. This is a signal for us to recognise and respond to. However, because the rivers are surrounded by large urban or rural populations, the contaminants may eventually start degrading the water quality again, and the improvement obtained during the lockdown would not last for long. As a result, policymakers should take note of the improved water quality conditions as a result of the cessation of human activities and organise awareness campaigns and future actions appropriately.

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