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Eutrophication and Living Beings

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Editorial

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The earth's freshwater resources are limited about 99% of the earth's water is saline (and becoming more so by the actions and activities of man), and only 0.3% of the world's freshwater is usable. Driven by rapid industrialisation in the developing world, food production, energy demand, population growth, climate change and the environment, it is estimated that 50% of the world's people will live with chronic water stress by the year 2025 ^[1].

Water pollution is the contamination of water bodies (e.g. lakes, rivers, oceans, aquifers and groundwater), very often by human activities. The 6 billion people alive today consume about 25 million tonnes of protein nitrogen each year, a requirement that could well increase to 40–45 million tonnes by 2050 ^[2]. Water pollution occurs when pollutants (particles, chemicals or substances that make water contaminated) are discharged directly or indirectly into water bodies without enough treatment to get rid of harmful compounds. Pollutants get into water mainly by human causes or factors. Water pollution can be a Point-source, Non Point-source, or Tran boundary in nature. Water pollution can be classified into two broad categories: Point and Nonpoint source. Point source water pollution occurs when harmful chemicals or effluents are discharged directly into a river or other sources of water. The nonpoint source occurs when the harmful pollutants are discharged indirectly, through water runoffs caused by heavy rainfall. For example, when the fertilizers added to crops is discharged into a stream or lake by a water runoff.

While point sources can be monitored and controlled, it is difficult to monitor and regulate a nonpoint source. Most streams and lakes today get contaminated through nonpoint sources of pollution. We studied about the dissolved oxygen, alkalinity etc. and how global warming effected their life. By that we can remove all these impurities and get palatable water.

Water pollution is one of the hottest issues of these days. Water is a very important resource for people and the environment ^[3]. We are facing so many problems due to impurities present in water and it also effects on the quality of water, these impurities are in the form of PAHs, hydrocarbons, algae etc. In Lucknow, the main water supply is only from Gomti. Its, an important tributary of Ganga River and perennial river of Awadh plains runs across the major parts of Uttar Pradesh, covering nine districts and a distance of approximately 940 km. During its course, Gomti River receives huge quantities of untreated sewage agricultural run offs which brings lot of pesticides, fertilizers, street washouts bringing oil, asphalt, sediments; industrial wastes all of which significantly alter the physico-chemical characteristics of its water.

In Lucknow city, various industries like distillery, milk dairy, vegetable, oil, carbon etc are pouring effluents directly into the Gomti as it is the only source of water for the nearby communities. Due to increased pollution levels water quality of Gomti is deteriorating continuously. Increased level of turbidity makes Gomti River water unpalatable, hence making it a matter of concern. Gomti River receives industrial as well as domestic wastes from various drains of Lucknow city. In the process the water and sediment of the river Gomti get contaminated with heavy metals and other pollutants. Non-regulated loads lead to the break of natural physical and chemical characteristics of water bodies, loss of biodiversity, degradation of structure and functions of biological communities and, as a result, to decreasing of potential ecosystem services ^[4].

Recently the banks of river Gomti in Lucknow were unusually abuzz. Some people were struggling to wade through the 'sewage-enriched' river to scoop up thousands of dead fish; the bystanders looked on, probably contemplating the peril their city's lifeline. The river is one of the major sources of water for Lucknow.

We observed that fish died due to decrease in dissolved oxygen level of the river water, but this is not only because of sewage, some other factors are also responsible for that. For getting the complete information about this our officials of the pollution prevention board blame untreated muck for the sad situation. S C Rai, the mayor of Lucknow, however refutes the claim: "The mass killing of fish has not been caused by sewage; it is industrial effluents discharged by paper mills, sugar factories and distilleries in the upstream areas of Sitapur and Lakhimpur-Kheri that spelt doom for the aquatic life." The dissolved oxygen levels dipped to as low as one milligramme per litre (mg/l) ^[5]. A minimum level of four to six mg/l is considered essential to sustain aquatic life.

Over the years, Gomti has become the most polluted river in Uttar Pradesh. Monitoring by the state pollution control board reveals the water is unfit for consumption. The extent of pollution is such that the river's biodiversity is being affected. A marine species of molluscs – *Solariella* – was recently found in the river. This is alarming, as *Solariella* is endemic to coastal waters that ordinarily have high levels of pH (read: alkaline/ polluted conditions). The presence of *Solariella* was revealed during the first-ever biomapping of the river done by the Geological Survey of India (GSI), Lucknow.

The invertebrate may have been introduced in the river by birds like waders. But since then it has been able to survive in the rivers freshwater due to high levels of pH. In other areas such as Madhavpura, Isauli and Bashariaghat, GSI scientists found *Hemicypris arorai* – another organism that survives in highly alkaline water (pH values of 8.2 to 9.1). The high pH levels of these areas were mainly attributed to the use of fertilisers in nearby fields ^[6]. To further prove that pollution is changing the river's biodiversity, GSI scientists tested water samples from the tributaries of Gomti. The samples were found to be free of *Solariella* and *H arorai*.

According to experts, the riverine biota being affected by pollution is an indicator of an impending ecological disaster ^[7]. The oxygen level in the water might have fallen because of various reasons. First, the rise in temperature had caused a drastic fall in the water level. A brief spell of rain also brought garbage into the river, following which dissolved oxygen level decreased dramatically ^[8]. Our team has taken samples of water for examination and perform the experiment and we found that the level of DO was around 5.5 ppm ^[9].

Therefore we can say for surviving the fish at least we required that the dissolved oxygen should be around 3 mg per litre for survival of fish ^[10]. Anything below that may lead to fish mortality, the oxygen levels in the river invariably comes around 5-6 miligram per litre, which is considered to be safe.

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