



# Studies on Effects of Chemical Water Pollutants on the Aquatic Lives in the Bagmati River in Sitamarhi & Sheohar

**Dr. Mukesh Kumar Sharma**

Assistant Professor, Department of Chemistry,  
M.L.S.M. College, Darbhanga, Bihar,  
India

## **Abstract:**

This study explains the effect of chemical water pollutants on the living things and health of aquatic life in the Bagmati River in Sitamarhi and Sheohar, Bihar. The study shows the toxic wastes produced from industries which damages the aquatic lives. The toxic gases emitted by the industries also creates air pollution. The toxic materials produced also generates soil pollution and damages the plants and crops cultivated by local farmers and through rain water allows to flow in river making the aquatic life dangerous. This study also explains how the farms have raised pollutant levels in the water, harming the health of aquatic species. This research observes a strong connection between high concentrations of heavy metals and reduction in the number of species along with damaged fishes. These affects the aquatic ecosystem and biodiversity and also harm humans through the food chain by accumulating toxins.

This research focuses the need of effective water quality management and public health policies to reduce the pollution, protect the ecosystem and improve the community health. This research focuses how the environmental health be improved and methods to solve water pollution problems. This study also generates a healthier ecological and social environment. There is also a need for local farmers to protect the crops from toxic wastes produced by the industries.

**Key Words:** Aquatic life, Pollutants, Public health, Bioaccumulation, Effluents, Biodiversity loss, Ecosystem, River

## Introduction:

The fresh water ecosystem damaged by chemical pollutants continues to be pressing global concern, adversely affecting biodiversity and human health. The Bagmati River, flowing through several areas of Sitamarhi and Sheohar district of Bihar is a great natural resource that supports diverse flora and fauna. However, this aquatic resource faces a big problem from anthropogenic activities, mainly industrial discharge,

agricultural runoff and urban wastes which collectively contribute to damaging water quality. The chemical pollutants like heavy metals and organic contaminants make water quality worse. The previous studies have shown that aquatic organisms are sensitive to these pollutants, which damages biodiversity and the way of working ecosystem. It is to be noted that this is important because the aquatic life is essential for balancing ecosystem and also indicates the wealth of ecosystem.

This study explains that how chemical pollutants harms the health and diversity of aquatic organisms in Bagmati River. The main focuses are:

1. To identify and measure the concentration of various pollutant in the river and link them to the decline in the richness and the health of aquatic species.
2. To assess the water quality to find specific pollutants on aquatic lives.
3. To evaluate that how these pollutants harm the aquatic lives especially aquatic species diversity and physiological health.
4. To create management recommendation to deal with pollution in the river ecosystem.

The research has both academic and practical value for public health and environmental policy. By elucidating the extent to which chemical pollutants affect the aquatic lives of Bagmati River, the study informs stakeholders and policymakers, raises community awareness and promotes sustainable practices to protect water quality and biodiversity. The findings will add to knowledge about environmental health and management, highlighting the need for integrated approaches to reduce pollution in freshwater resources.

## **Literature Review:**

The aquatic ecosystem is increasingly affected, mainly in areas where industrialization and urbanization exert a lot of pressure on local water bodies. Rivers are critical lifelines for biodiversity but they often collect many pollutants from farming runoff, industrial waste and household sewage. Knowing the impact of these pollutants on water life is essential to making good management plans. The Bagmati River flowing the areas of Sitamarhi and Sheohar, Bihar shows these problems clearly. The parts of the river are being affected by chemical pollutants that harm the aquatic lives.

The recent studies have shown a direct connection between water quality and the

variety of aquatic life. The concentration of chemical pollutants can change the aquatic lives and a lot of ecosystem function, leading to a big problem in fishes because they affect the reproduction in fishes. The recent study also links the environmental health to human being, since local communities depends on the river for drinking water, fishing and recreation. The previous study on chemical pollutants have focused on industrial areas specially, leaving gaps about rural or semi-urban areas of the Bagmati River. Studies have documented the toxic effects of heavy metals, pesticides and pharmaceuticals found in fresh water ecosystem and harm fishes and other aquatic species. For example, chemical pollutants affect fish reproduction and causing sharp population declines.

There is growing knowledge about the aquatic lives react to chemical stress at the biochemical level, which can help conservation and restoration efforts. However, this knowledge has not been applied to the specific ecological and socio-economic situation of the Bagmati River basin, where unique species and local conditions may lead to

different outcomes. Also, there is a little investigation into the socio-economic effects of aquatic pollution in this region. Pollution in the Bagmati River harms the aquatic species and the people who depend on the river for their livelihood. Researchers have not studied enough about chemical pollutants affecting the aquatic life of the river.

We need to measure how much pollution is in the river and also how it affects the local environment, health and economy.

The previous studies focus at how chemical pollutants of water affect the aquatic life of Bagmati River. It wants to:

1. Summarize what is already known about the problem.
2. Find gaps in the knowledge that need more research.
3. Help to create a complete understanding of how chemical pollutants affect the ecosystem of semi-urban river.

Earlier studies<sup>1</sup> showed heavy metals in the river which harms the fishes. Later work<sup>2</sup> looked at pesticides in fishes and linked agricultural runoff to water health. Other researchers<sup>3</sup> studied that how nutrients from sewage and farms cause eutrophication, which harms fishes and the whole ecosystem. Some studies<sup>4</sup> found that chemicals reduce biodiversity. Recent work<sup>5</sup> shows that several pollutants can make the stress on aquatic life even worse. In short, the paper wants to bring together existing the research on chemical pollutants in the Bagmati River, showing the need to learn and use this to guide future environmental management and protection. Such insights have prompted calls for more integrated management approaches, as highlighted by advocating for comprehensive pollution control measures in the region<sup>6</sup>. The chronological development of this body of research illustrates a growing understanding of the complexities of chemical pollutants and their multifaceted impacts on the aquatic ecosystem of the Bagmati River, understanding the need for ongoing

examination and intervention to safeguard these vital habitats. Chemical pollutants in the river are causing more damage than any single pollutant. Research shows that heavy metals like lead and chromium harm fishes, reducing their growth and ability to reproduce. These toxins affect the fishes as well as the whole ecosystem, including animals and people who eat the fishes.

The study also finds that increased chemical pollutants correlate with diminished diversity in aquatic populations, particularly among sensitive species. Agricultural and industrial waste degrades the river habitat, allowing invasive species to take over. This harms local fishing communities because catches drop and health risks rise from eating contaminated fish. The research stresses the need for better pollution management. It recommends stricter rules on industrial waste and raising community awareness to protect the ecosystem of Bagmati River. Researchers have studied how chemical pollutants affect the aquatic lives in Bagmati River. The results have varied, creating various topics on the research. Some studies use lab experiments to explain the effect of chemical pollutants. These experiments show how these pollutants damage the health of aquatic organisms. For example, controlled toxicity tests describe the clear connection between pollutant levels and the death rates of fishes held by biochemical changes caused by chemical pollutants.

Researchers focus these findings by studying real conditions in the ecosystem of river. The monitoring of water quality and living beings in water shows that how chemical pollutants are changing the biodiversity and distribution of aquatic organisms. This method explains the connectivity of lab and field data which describes the pollutant effects.

Some researchers also use socio-ecology methods to describe the effects of chemical pollutants on aquatic lives.

They study the chemical wastes which affect the food-web interactions. This analysis explains the direct effect on individual organisms and the large effect on them. The qualitative and quantitative methods help them to give a complete result of the environmental and ecological studies of water pollution in this region. New analytical method such as molecular method improves the knowledge of chemical pollutants affecting the aquatic species, making the research stronger in this field. The connection between chemical pollutants in water and aquatic species in the Bagmati River has more attraction in scientific attention. Ecotoxicology theories explain a complicated method to explain the effect of chemical pollutants on aquatic lives. Researches indicate that heavy metals and organic pollutants in the river harms the fish health, behavior and reproduction, aligning with finding from which, identify critical toxicity threshold for different species<sup>1&2</sup>. Additionally, trophic cascade theory explains the effect of pollutants changing in species that disturbs the balance of ecosystem<sup>3&4</sup>. Furthermore, human activity theory focuses on pollution sources, pointing out that industrial waste and farm runoff are the important sources for

degradation in water quality. Studies in similar environments support this, showing a clear connection between pollutant levels and loss of biodiversity in aquatic ecosystem. However, some researchers argue against the notion that all pollutants have uniformly negative impacts, suggesting that certain adaptations can make species more resilient<sup>7&8</sup>. Combining these ideas gives a deeper understanding of how chemical pollutants disturb aquatic life. Mixing ecotoxicology with human-activity theories and adding ideas about the adaptation of species, a complete picture of the problems in the ecosystem of Bagmati River which generates a better water management policy.

In reviewing the extensive body of literature concerning the effects of chemical water pollutants on the aquatic life of the Bagmati River in Sitamarhi and Sheohar of Bihar, reveals key findings. A basic result is that heavy metals, pesticides, and other toxins harms fish populations, slowing their growth, damaging reproduction, and reducing biodiversity. Furthermore, the studies also show these pollutants build up in organisms and disrupt food webs, affecting higher trophic levels and making the whole ecosystem unbalance. This evidence proves the water quality is linked to biodiversity. When pollution rises, sensitive species suffer and are replaced towards more resilient, often invasive species. The effects of these findings extend well beyond ecological concern as they underscore the socio-economic ramifications that pollution poses for local communities depending on the aquatic resources of the Bagmati River. A number of fishes are damaging which harms the livelihood of fishermen. At the same time, by eating polluted fishes people falls sick which makes fishing communities uncomfortable. This indicates that the environmental health and human health are corelated and hence strong policies are required for saving water resources.

Current research is focused on chemical pollutants, while several pollutants are damaging water ecosystem. There are also several studies which link ecological damage to the social and economic effects affecting local communities.

Current analytical methods are growing our knowledge about pollutants which harms aquatic lives, but there is also a requirement for aquatic life adaptation to this stress so that some species may be more resilient.

Further current study should focus on:

1. Investigating the combined effect of several pollutants on water species to get a complete picture of their effects and guidance of better management<sup>9</sup>.
2. Examining the socio-economic consequences of pollution, including overall assessments of community health and economy to make a perfect policy<sup>10</sup>.

Involving local stakeholders in these studies will ensure that management plans are rooted in the lived experiences of people most affected by environmental degradation.

In short, the literature reviewed underscores the need for a broad approach that considers both ecological and socio-economic factors in addressing the effects of chemical pollutants on the aquatic lives in the Bagmati River. By filling knowledge gaps and creating a better understanding of how human activities interact with aquatic ecosystems, we can improve conservation efforts.

## **Experimental Method and Methodology:**

Scientists are worried about chemical pollutants in water that harms aquatic life. This study looks at the Bagmati River in Sitamarhi and Sheohar, Bihar, where industrial waste and farm runoff have contaminated the river water dirty and harmed fish and other aquatic species. The research focuses on measuring the pollutant levels in the river and observing how they affect fish populations and biodiversity directly.

Previous studies<sup>1</sup> have not explored this enough. The main goals are:

1. To find the major pollutants in water.
2. To measure the concentration of chemical pollutants in the water.
3. To find the toxicity of chemicals affecting the common aquatic lives in the Bagmati River ecosystem.

This approach uses both field sampling and laboratory analysis to get accurate water-quality data and specific impacts of chemical pollutants on aquatic species. It follows methods used in freshwater studies and collects water samples in different seasons to see how chemical pollutants affect the aquatic lives. This temporal examination is important for understanding how seasonal changes affect contaminant behavior and organism responses as documented in analogous studies. The analysis will check both common pollutants like heavy metal concentrations and newer contaminants such as pharmaceuticals or personal-care products, affecting the freshwater ecosystem. The significance of this methodology is important not only for adding to scientific knowledge about chemical behavior in freshwater systems but also in its practical implications for local governments and ecological managements. It will provide the data that illustrates the specific threats posed by chemical pollutants in the aquatic life of Bagmati River and guide environmental management decisions. This research aims to inform policy decisions and establish a foundation for future intervention strategies. Moreover, engaging with local communities in monitoring pollution initiatives will rise awareness about pollution problem and promote collaboration conservation efforts, highlighting the

multifaceted impact of pollution on health and livelihood. Therefore, the chosen methodology is expected to fill knowledge gaps and match the main research questions about the environmental health of the Bagmati River. In conclusion, employing this structured and evidence-based methodology will bolster the dissertation's exploration of chemical water pollutants and their effects on

aquatic life, helping both theoretical and practical management in the region. The integration of diverse analytical methods will ensure a full assessment that contributes significantly to both academic research and local conservation projects. With careful execution, it is expected that this study will yield insights that can change our understanding of aquatic ecosystem dynamics when faced with pollution.

## **Results:**

The water in the Bagmati River has been attributed to the growing levels of chemical pollutants dumped from industrial and agricultural runoff. The study provided a complete assessment at the water quality of river by taking samples in the fields and testing them in laboratory to see how the pollutants harm aquatic life. The main results are observed that the river has high concentration of heavy metals like lead and cadmium surpassing the above limits allowed by environmental rules. Additionally, the water has higher biochemical oxygen demand (BOD) and total dissolved solids (TDS), which means that water quality has deteriorated<sup>1</sup>. The presence of these pollutants was strongly linked to a big fall in fish species diversity with population and sensitive Indian Major Carps, whose numbers are shrinking in the affected areas. These findings align with previous studies showing the detrimental effects of heavy metal accumulation on aquatic organisms and reduce their health, which has been documented to lead to describe biodiversity and raise death rates in the freshwater ecosystem. Comparatively, studies from other regions also confirms that industrial pollution is common in many rivers, causing big ecological problems. Furthermore, the measured parameters in this study were consistent with those reported by many researchers, who found similar trends in the tributaries of contaminated rivers throughout India. The results matter is not just for the environment, but they show urgently need for good water-management policies and conservation strategies to avoid pollutants and preserve aquatic biodiversity. Addressing these contaminants, they harm aquatic species and affect humans who depend on these resources for livelihoods. The study supports with earlier calls for integrated management practices in water ecosystems and stresses that pollution control must be a prioritized to restore ecological balance and protect aquatic life. In summary, the research gives strong evidence effect of chemical pollutants on aquatic lives in the Bagmati River. It demands immediate laws and community awareness campaigns to promote sustainable practices and safeguard these important water resources. Such efforts are essential for both the aquatic ecosystem health and the well-being of people who depend on them.

## **Discussion on result:**

The chemical pollutants are affecting aquatic ecosystem and represent a significant global concern, mainly in where the industries and farms are active. A study on the Bagmati River of Sitamarhi and Sheohar, Bihar, shows that the water quality is deteriorated due to increased chemical pollutants like heavy metals and organic wastes. The research found alarming levels of heavy metals like lead and cadmium, which are above the environmental guidelines<sup>1</sup>. Additionally, it also found high concentration of biochemical oxygen demand (BOD) and total dissolved solids (TDS) levels in the water, demonstrating a direct link with community composition and the diversity of aquatic lives<sup>2</sup>. Notably, a significant fall in fishes has been found, with sensitive species, mainly Indian Major Carps affected. These results are similar to earlier studies on aquatic lives due to heavy metals in freshwater ecosystem. Various studies show that high levels of heavy metals in water reduce biodiversity and raise the death rates of aquatic species. Theoretically, this research stresses the chemical pollutants as the major stressors in the water ecosystem and highlights the regulations to stop the pollution. Practically, this research underscores the urgent requirement for pollution control by combined monitoring system for agricultural and industrial practices to improve water quality. Methodologically, the study pushes for combined monitoring for both chemicals and biodiversity for better health of aquatic lives. Additionally, the link between the concentration of pollutants and ecological indicators calling for integrated management plans to restore the ecosystem. Ultimately, the contamination in Bagmati River is like those in other polluted freshwater systems worldwide and need local research and action to shape national water policies. The works on contamination matters of Bagmati River, it requires a good public health, a perfect aquatic life and sustainable use of river resources. Future studies should add longitudinal monitoring and community engagement to target the pollutant burden on this vital ecosystem.

## **Conclusion:**

Addressing the adverse impacts of chemical pollutants on aquatic lives in the Bagmati River has highlighted significant concerns regarding the ecological health of this vital ecosystem. This dissertation shows that the Bagmati River has high concentration of heavy metals and other organic contaminations harming aquatic lives. These pollutants are directly linked to poor water quality and fall in aquatic biodiversity, mainly for sensitive fish like Indian Major Carps<sup>1</sup>. The research used both chemical tests and ecological assessments to prove that high concentration of chemical pollutants harm aquatic lives.

The study has several implications of the findings. It adds to scientific knowledge by identifying chemical pollutants as major stressors in freshwater ecosystems

underlining the necessity for robust regulatory framework and highlights the need for strong pollution-control regulations. Practically, it urges the adoption of sustainable industrial and agricultural practices in the region which can alleviate the ecological burden on the Bagmati River and protect aquatic species. Future, research should keep monitoring pollutants and their impacts on aquatic life, looking at both short-term and long-term effects to understand the intricate dynamics involved. Additionally, research can also explore potential for bioremediation techniques as a way to provide innovative solution to restore the ecological balance in Bagmati River. As this study has indicated that pollution is tied to reduced biodiversity, efforts should also focus on community engagement and education problem to raise awareness about how water pollution affects public health and ecosystem sustainability. Integrated management plans that balance human needs with ecological needs are essential for the long-term visibility of the Bagmati River and its aquatic life. The findings of this dissertation provide a foundation for further studies, aiming to fill gaps in knowledge about how chemical pollutants affect aquatic lives and thus providing valuable insights for environmental policy and conservation efforts.

## **References:**

1. Damini Rana, Namita Joshi and Abhishek Nandan: Impact of Land Use on Water Quality Dynamics: Seasonal and Longitudinal Variations in the Rispana and Bindal Rivers of Dehradun, Uttarakhand, India- Journal of Environment and Bio-Science, 2024.
2. Yulia Vanchosovych, M. Whitten, C. Woolston: Water Quality in the Chattahoochee River and the Impacts of a Major Metropolitan Area 2017.
3. Ewa: Seasonal Variations in Heavy Metals Status of the Calabar River, Cross River State, Nigeria, 2013.
4. Ayodeji Abatan, Alexander Obaigbena, Ejike David Ugwuanyi, Boma Sonimitiem Jakes, Uchenna Joseph Umoga, Onyeka Henry Daraojimba, Oluwaseun Augustine Lottu: Integrated Simulation Frameworks For Assessing The Environmental Impact of Chemical Pollutants in Aquatic Systems- Engineering Science and Technology Journal.
5. Bobir a. Odilov, Askariy Madraimov, Otabek Y. Yusupov, Nodir R. Karimov, Rahima R. Alimova, Zukhra Z. Yakhshieva, Sherzod A. Akhunov: Utilizing Deep Learning and the Internet of Things to Monitor the Health of Aquatic Ecosystem to Conserve Bio-diversity- Natural and Engineering Sciences, 2024.
6. N. Onistratenko, Alexey Egorov: "Analysis and Mapping of Anthropogenic Load of Aquatic Ecosystems in the Southern Part of the Volgograd Agglomeration" Natural Systems and Resources, 2024.
7. Marija Perovic: Evaluating Micropollutants in the Danube River: Assessing

Concentrations and Environmental Impact- Proceeding IIZS 24, 2024.

8. Hazim Aziz Al-Robai, Dheyaa J. Jasim, Safiyya A. Jassam, Hayder M. Jasim, H. F. M. Ameen, A. Al-Rubaye: Petroleum's Influence on the Aquatic Environment- IOP Conference Series: Earth and Environmental Science, 2023.
9. Pandiyan, a. Poiyamozhi, S. Mahboob, K. Al-Ghanim, F. Al-Misned, Z. Ahmed, I. Manzoor, et al.: "Assessment of the Toxic Effects of Heavy Metals on Waterbirds and Their Prey Species in Freshwater Habitats" Toxics. 2022.
10. Sonika Kushwaha: Heavy Metal Concentrations in Feather of Critically Endangered Long-Billed Vultures (*Gyps Indicus*) in Bundelkhand Region, India- The International Journal of Life-Sciences Scientific Research, 2016.

