HIMALAYAN JOURNAL
OF BASIC & APPLIED SCIENCES
An open-access, peer-reviewed platform for basic and applied sciences
himalayanjournal.org
RESEARCH ARTICLE
Volume: 2 | Issue: 3
Date, Month, Year: 1, June 2026
Pages: 60-63
Doi: doi.org/10.5281/zenodo.21297546
ISSN (Online): 3107-9113
editor@orchidsocietyofassam.com

Study on the water quality and menace of Water hyacinth in Sonai River, Rupahi, Nagaon, Assam

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Abstract

The Sonai River, spanning approximately 31.67 km from Tamulitup to Nagaon, is increasingly threatened by the invasive aquatic plant *Pontederia crassipes* (formerly *Eichhornia crassipes*). This study investigates the physico-chemical parameters of river water to identify factors contributing to the unchecked spread of water hyacinth. Elevated pH, total dissolved solids, biological oxygen demand and nutrient concentrations indicate severe deterioration of water quality. The proliferation of water hyacinth has disrupted aquatic biodiversity, obstructed waterways and imposed socioeconomic challenges on local communities. The findings emphasize the urgent need for integrated management strategies, combining ecological restoration, community engagement, and sustainable utilization of water hyacinth biomass to revive the river's ecological health.

Keywords: *Water hyacinth, Sonai River, Water quality, Pollution, Nagaon, Assam.*

Introduction

Freshwater ecosystems are indispensable for human survival, agriculture, fisheries, and biodiversity conservation. Globally, rivers are under increasing stress due to anthropogenic activities such as industrial effluents, agricultural runoff, sewage discharge, and urbanization [1]. In India, rivers are often subjected to multiple pressures, leading to declining water quality and biodiversity loss [2].

The Sonai River, a tributary of the Kolong River, flows through Rupahi township in Nagaon district, Assam. It plays a crucial role in supporting local livelihoods, irrigation, and fisheries. However, in recent years, the river has been severely infested by water hyacinth (Pontederia crassipes), one of the world's most aggressive invasive species [3]. Originating from the Amazon basin, water hyacinth has spread to over 70 countries, where it disrupts aquatic ecosystems, obstructs navigation, and reduces water quality [4].

The unchecked growth of water hyacinth in the Sonai River has led to ecological imbalance, reduced dissolved oxygen levels, and hindered the free flow of water. This study aims to assess the physico-chemical characteristics of the river water and evaluate the extent of pollution contributing to the proliferation of water hyacinth.

Materials and Methods

Water samples were collected monthly from three sites along the Sonai River between March, 2024 and February, 2025 to capture seasonal variations at Sonai River, Rupahi of Nagaon district of Assam (Fig.-1). Sampling was carried out in the morning using BOD containers, with all samples properly labeled and transported to the laboratory. The selected sites represented different levels of human influence (Fig.-2) Site - 1 near agricultural fields, Site- 2 adjacent to Rupahi bazar and sewage inflows, and Site- 3 downstream in a relatively less disturbed area.

Physico-chemical parameters analyzed included temperature, pH, turbidity, total dissolved solids (TDS), dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), total hardness,

Received:30th *May*, 2026; *Revised & Accepted: 20th June, 2026;* Published *Online*: 25th *June, 2026*

Published by Orchid Society of Assam

sulphate, fluoride, phosphate, ammonical nitrogen, and organic nitrogen. All analyses were conducted following the standard protocols outlined by the American Public Health Association [5].

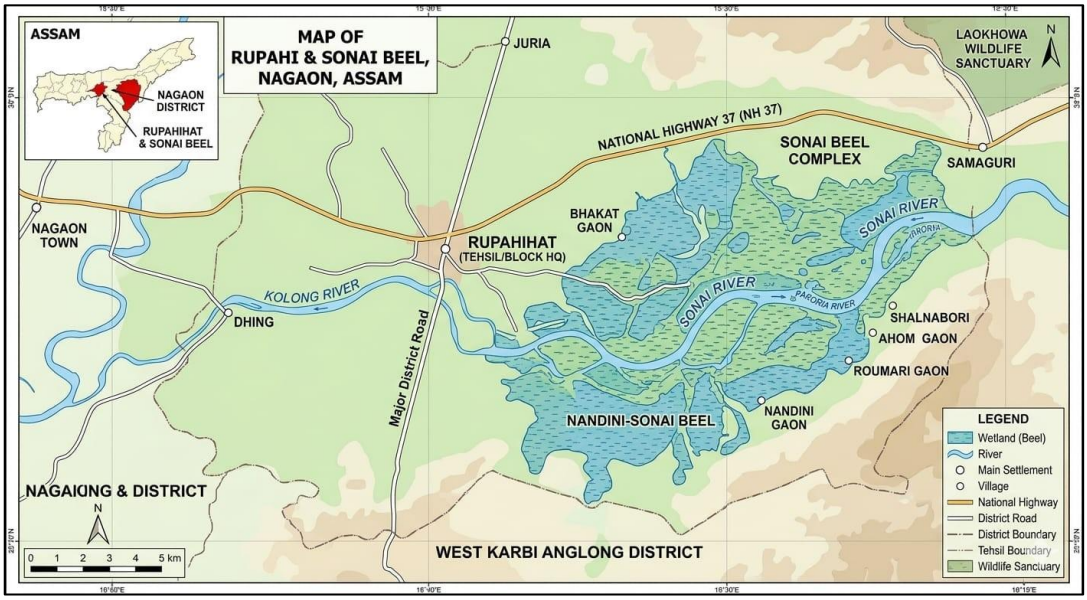

Fig-1: Map of Sonai River, Rupahi, Nagaon, Assam

Site-1 Site-2

Site-3

Fig 2: Selected sites of studied area. Site-1: Near Agricultural Field. Site-2: Adjacent to Rupahi Bazar. Site-3: Downstream area of relatively less disturbed area.

Results and discussions

The analysis of water samples from the Sonai River revealed clear signs of deterioration. Temperatures across all sites were above the permissible limit, creating unfavorable conditions for aquatic life and encouraging the spread of invasive water hyacinth (Pontederia crassipes). Elevated temperatures are known to

accelerate eutrophication and promote hyacinth dominance, which has been widely documented in tropical freshwater systems [6], [3].

The pH values were consistently alkaline, ranging from 8.9 to 9.1, which further stresses aquatic organisms and reflects pollution inputs. Alkaline conditions often arise from domestic sewage and industrial effluents, and such deviations from neutrality are detrimental to fish and benthic fauna [7].

Total dissolved solids (TDS) were nearly double the acceptable limit, indicating mineral enrichment and contamination. Elevated TDS levels are symptomatic of anthropogenic inputs, including agricultural runoff and improper waste disposal, which remain major challenges in India's river systems [2].

Dissolved oxygen (DO) levels varied, with lower values at Sites 1 and 2 suggesting organic pollution, while Site 3 showed relatively better aeration. However, biological oxygen demand (BOD) was consistently high, confirming heavy organic load, especially near sewage inflows. High BOD and chemical oxygen demand (COD) values are strong indicators of oxidizable pollutants and organic enrichment, consistent with findings from similar riverine studies in Karnataka and Assam [1], [8].

Nutrient concentrations, including phosphate, ammonical nitrogen, and organic nitrogen, were well above permissible limits, fueling eutrophication and uncontrolled hyacinth growth. Excessive nutrient loading has been identified as a primary driver of hyacinth proliferation, leading to biodiversity loss, obstruction of waterways, and socioeconomic impacts on local communities [4], [9].

Overall, these findings demonstrate that the Sonai River is under severe ecological stress. Excessive nutrients and organic matter have created conditions that favor invasive water hyacinth, which in turn reduces biodiversity, obstructs navigation, and impacts local livelihoods. The results highlight the urgent need for management interventions to restore ecological balance and mitigate the socioeconomic impacts of this invasive species [10], [5].

Table 1: Average Results on Laboratory Report of collected samples

Parameters	Permissible Limit	Sample Code		
		Site-1	Site-2	Site-3
Water Temperature $(^{\circ}C)$	25-32	34.7	34.4	33.1
p^H	6.5-8.5	9.1	9	8.9
Total Dissolved Solids(mg/L)	≤500 mg/L	976	862	989
Dissolved oxygen (mg/L)	6.5- 8 mg/L	4.6	5	9.5
Biological Oxygen Demand(mg/L)	5 mg/L	8.87	11.21	9.31
Chemical Oxygen Demand(mg/L)	250 mg/L	330	145	138
Total Hardness(mg/L)	300 mg/L	278	267	289
Sulphate(mg/L)	≤0.002mg/L	8.9	28.7	34.8
Fluoride(mg/L)	1.5 mg/L	0.51	0.61	1.89
Phosphates(mg/L)	0.1 mg/L	1.89	1.12	1.90
Ammonical Nitrogen(mg/L)	≤1.2 mg/L	4.97	6.1	5.2
Organic Nitrogen(mg/L)	≤1.0 mg/L	60.8	25.5	60.9

Conclusion

The physico-chemical assessment of the Sonai River clearly indicates poor water quality, with elevated pH, high dissolved solids, excessive organic load, and nutrient enrichment driving eutrophication and the uncontrolled spread of water hyacinth. While the plant has some phytoremediation potential, its unchecked growth disrupts aquatic ecosystems, reduces biodiversity, and hampers local livelihoods. Effective

management strategies—combining biological control, sustainable utilization of hyacinth biomass and community participation—are urgently needed to restore the river's ecological balance and ensure long-term conservation.

Acknowledgement

The authors express their sincere gratitude to the faculty and staff of the Department of Zoology, Dhing College and Rupahi College for their valuable support and encouragement throughout this study. We are indebted to the local communities of Rupahi and adjoining areas for sharing their observations and facilitating fieldwork along the Sonai River. Special thanks are due to the laboratory assistants for their cooperation in water quality analysis and to colleagues who provided constructive suggestions during the preparation of this manuscript.

Conflict of Interest: The authors declare no conflict of interest regarding this paper's content, authorship or publication.

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